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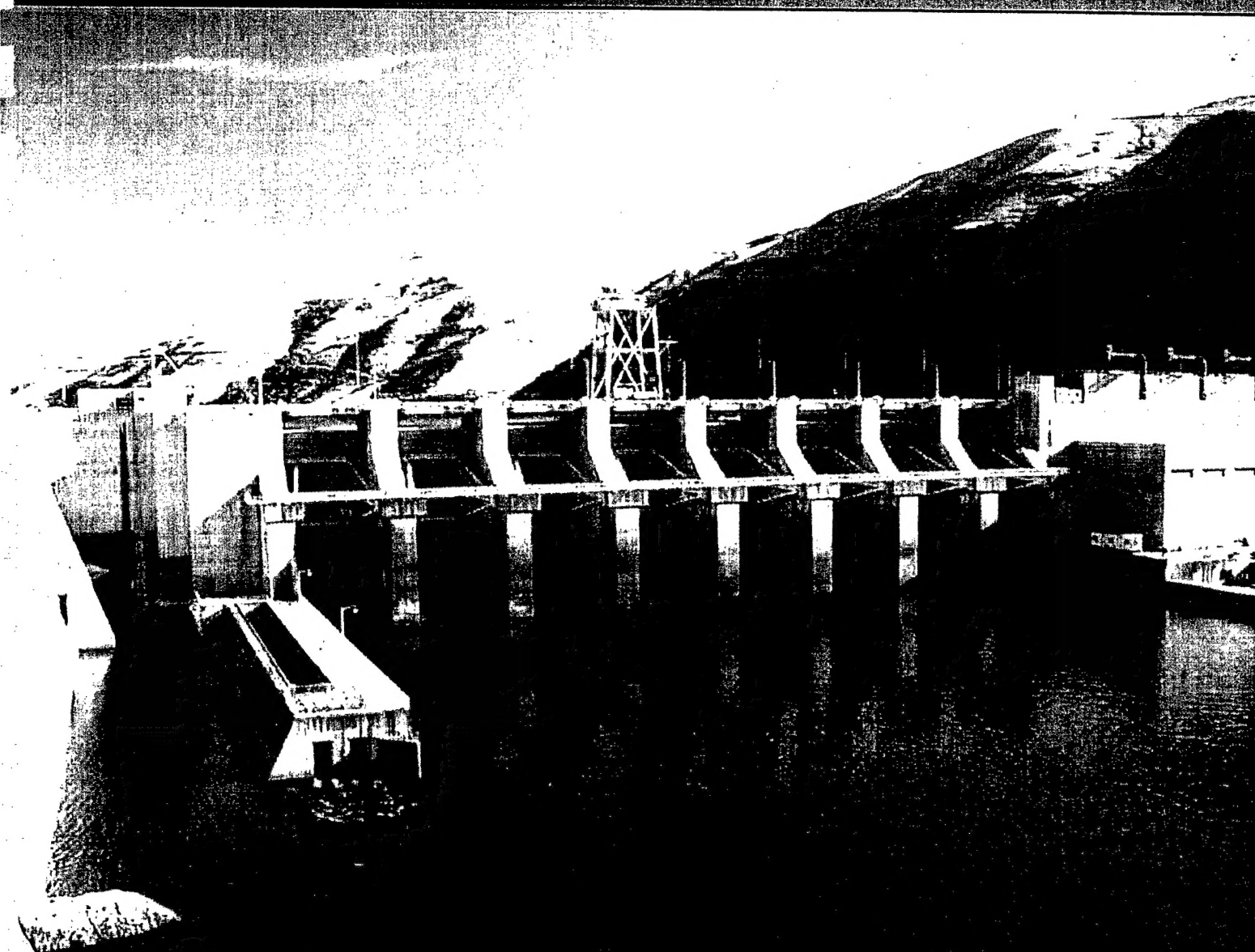
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# Lower Granite Dam

## Radial Gate Inspection and Testing



US Army Corps of Engineers, Walla Walla District





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# **LOWER GRANITE DAM RADIAL GATE INSPECTION AND TESTING**

## **INTRODUCTION**

### **Purpose**

The Corps of Engineers, Walla Walla District, requires a comprehensive evaluation of the radial gates at Lower Granite Dam. The District retained HDR Engineering, Inc. to perform inspection and testing of the radial gates through Task Order No. 5 under Contract DACW68-00-D-0001. The task order scope of work includes review of project information, an initial meeting and inspection, comprehensive field inspection of the radial gates, testing of gate hoist machinery, recording trunnion movement, nondestructive testing of field welds, and preparation of a report.

### **Scope of Investigation**

The scope of this investigation includes:

- Review of design, construction, maintenance and operations information provided by the District.
- Hands-on visual inspection of accessible upstream and downstream portions of eight radial gates.
- Visual inspection of the hoists and hoist equipment.
- Nondestructive testing of field splice welds.
- Testing of gates and hoists while operating.
- Recording trunnion movements while raising gates in both loaded and unloaded condition.
- A report including documentation of the design and operation of the gates and hoists, inspection and testing results, conclusions, and recommendations.

### **Limitations**

The services under this contract include the professional opinion and judgment on the data and information reviewed. The conclusions and recommendations presented in this report are based on the information provided by the District and the inspection and testing of the radial gates and hoists. The inspection was visual only and only accessible portions of the components were inspected. Nondestructive testing was performed on field splice welds, but no laboratory testing was conducted in the course of the inspection.

## PROJECT BACKGROUND

### Project Description

Lower Granite Dam is located in southeastern Washington on the Snake River, 37.2 river miles upstream of Little Goose Dam, and 107.5 miles above its confluence with the Columbia River. The main project structures include a powerhouse, navigation lock, fish facilities, concrete non-overflow sections, and a rockfill embankment on the north shore. The dam is 3,200 feet long including the embankment. Construction of the project began in August 1965 and was completed in November 1975.

The spillway is 512-feet-long and is located about mid-river. The spillway consists of eight radial gate controlled bays separated by 14-feet-wide piers. The radial gates are each 50-feet wide by 60.15-feet-high. The gates are numbered 1 to 8 from left to right looking downstream. The spillway structure has a maximum height of 204.4 feet with the deck at Elev. 751.0. The spillway crest is at Elev. 681.0 and the top of gates at Elev. 740.0. The reservoir stores 483,800 acre-feet at normal full pool (Elev. 738.0).

The Spillway Design Flood (SDF) is 850,000 cfs. The spillway has a design capacity of 850,000 cfs at reservoir level Elev. 746.5. The maximum spillway capacity at normal full pool (Elev. 738.0) is 680,000 cfs. For the period from 1951 to 2000, the maximum flood of record was 332,000 cfs on June 18<sup>th</sup>, 1974. Peak flow outside the period of record was 409,000 cfs on June 5<sup>th</sup>, 1894. These values are computed from the flood marks by the U.S. Weather Bureau.

### Gate Design and Construction

The Corps of Engineers designed the gates and project facilities. The gates were fabricated by Flint Steel Corporation of Tulsa, Oklahoma and Pacific Car and Foundry of Seattle, Washington. Stewart Machinery supplied the hoists.

The Walla Walla District provided copies of the engineering drawings and shop drawings for the gates. The gate and hoist specifications were also provided. The gates are very similar to the gates at Little Goose Dam. Notes in the District file indicate that the Little Goose calculations were used at Lower Granite Dam. See *Little Goose Dam Radial Gate Inspection and Testing* report for details on design. The following information was obtained from the Lower Granite Dam documents.

The 3/8-inch to 1/2-inch thick skin plate is supported by vertical ST10.5WF31 purlins. The skin plate is 3/4-inch thick on each end of the gate to act as a wear surface for the lifting cables. The purlins are connected to three horizontal plate girders. Each horizontal girder is supported by 14WF gate arms. The gate arms are braced with 14 WF members and there are ST7WF15 braces between the downstream flanges of the horizontal girders. Cable attachment brackets are mounted on the skin plate at the bottom corners. The horizontal plate girders, skin plate and cable

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attachment brackets are A537 Gr. A steel (Carbon-Magnesium-Silicon, Heat Treated for Pressure Vessels). All other members are A-36 steel.

The gate end frames were fabricated in two parts connected in the field with full penetration splice welds in the middle arms. The skin plate was installed in five vertical sections and joined by full penetration welds.

Each trunnion has a 24-inch diameter forged steel pin with a cast aluminum bronze bushing. The trunnions rest on a concrete girder that is anchored to the spillway piers with two groups of 48, 1-1/4 inch diameter prestressed bars.

The gates are raised and lowered by electric hoist units mounted on the deck above the gates. Eight 1-inch diameter wire ropes on each side of the gate wind on separate drums mounted on a common shaft. The hoist operating speed is approximately 1.1 feet per minute.

The gates have rubber J-bulb side seals and rubber wedge bottom seals. The side seal plates and sill beams are heated to prevent ice formation. The heating system consists of piping embedded below the seal plates. Electrically heated oil is automatically circulated through the piping when the ambient temperature drops below 32 degrees F.

### **Gate Operation**

The gates may be operated by manual control from stations located near each hoist, but normally the gates are remotely controlled from the powerhouse. All of the hoists can be powered from a diesel generator set.

The spillway is operated to pass the desired discharge with the best hydraulic conditions in the stilling basin. Through experience it has been shown that the most desirable stilling basin conditions are achieved with uniform discharge through all eight gates. The gates are opened in one-foot increments during the fish passage season from March 1 through December 31 according to the operating sequence in Table 1. If the desired spill exceeds the capacity of all eight gates for this spill pattern, then the gate opening sequence is repeated.

### **Gate Maintenance**

The District performs routinely inspects, tests, and lubricates the gates and hoists. Recent significant maintenance consists of:

- In the mid 1980s the upstream face of all gates were inspected and significant corrosion and wear was noted on the cable wear plates.
- The original coating for upstream and downstream portions of the gates was a four coat vinyl system. With the exception of spot painting, there is no indication that the gates have been recoated.

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Gate Number / Gate Stops								Total	Spill
1	2	3	4	5	6	7	8	Stops	(kcfs) <sup>1</sup>

(1) Forebay El. 737

1	0	0	0	0	0	0	0	1	1.75
1	0	0	0	0	0	0	1	2	3.50
1	0	0	0	0	0	1	1	3	5.25
1	1	0	0	0	0	1	1	4	7.00
1	1	0	0	0	1	1	1	5	8.75
1	1	1	0	0	1	1	1	6	10.50
1	2	1	0	0	1	1	1	7	12.37
1	2	1	0	0	1	2	1	8	14.25
1	2	1	1	0	1	2	1	9	15.99
1	2	2	1	0	1	2	1	10	17.86
1	2	2	1	1	1	2	1	11	19.61
1	2	2	2	1	1	2	1	12	21.48
1	2	2	2	2	1	2	1	13	23.35
1	2	2	3	2	1	2	1	14	25.27
2	2	2	3	2	1	2	1	15	27.14
2	2	2	3	3	1	2	1	16	29.06
2	2	2	3	3	2	2	1	17	30.93
2	2	3	3	3	2	2	1	18	32.85
2	3	3	3	3	2	2	1	19	34.77
2	3	3	4	3	2	2	1	20	36.67
3	3	3	4	3	2	2	1	21	38.61
3	3	4	4	3	2	2	1	22	40.53
3	3	4	4	3	3	2	1	23	42.45
3	4	4	4	3	3	2	1	24	44.37
3	4	4	4	4	3	2	1	25	46.29
3	4	4	5	4	3	2	1	26	48.21
3	4	5	5	4	3	2	1	27	50.13
4	4	5	5	4	3	2	1	28	52.05
4	5	5	5	4	3	2	1	29	53.97
4	5	5	5	4	4	2	1	30	55.89
4	5	5	5	5	4	2	1	31	57.81
4	5	5	6	5	4	2	1	32	59.73
4	5	6	6	5	4	2	1	33	61.65
4	6	6	6	5	4	2	1	34	63.57

**Table 1: Gate operating sequence**



## **INSPECTION**

### **General**

Wayne Edwards and Mike Haynes of HDR Engineering performed an initial site visit and inspection on April 5, 2000. Based on information collected during the initial inspection, HDR prepared an inspection plan and inspection sheets that were submitted to the District for review prior to the detailed inspection.

The inspection and testing of the spillway radial gates was performed from October 2nd through 9th, by Sam Planck, P.E., Heather Yee and Tony Barela, of HDR Engineering, Inc. Steve Schmidtkofer and Jim Knowles of K&N Electric inspected the hoists, took amperage measurements, and recorded observations during testing. Destry Hall and Jim Fisher of Kleinfelder performed nondestructive testing of field splice welds. Gary Struthers Associates was responsible for operation of the gates during the loaded and unloaded testing and moved the stoplogs between gate testing. Emerald Services, Inc., as a sub-contractor to Gary Struthers, provided water blast cleaning of the skin plate during the upstream face inspection. Gus Hernandez and Frank Gates (USACE) were present during the inspections and provided on site assistance. The weather was clear with temperatures ranging from 50 to 75 degrees F. The reservoir was full during the inspection. The upstream inspection of Gate 1 was not able to be performed initially because the surface collector was in place. Sam Planck and Amy Akins of HDR Engineering returned to the site on November 20<sup>th</sup> to complete the upstream inspection of Gate 1.

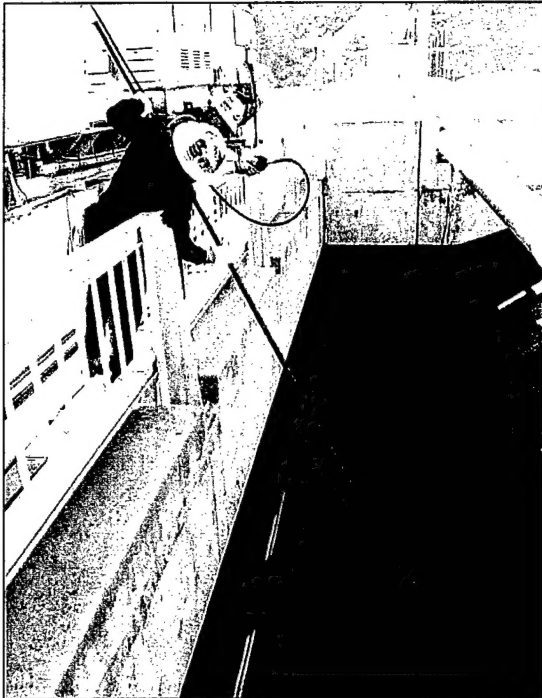
### **Procedures**

#### **Upstream Inspection & Testing**

For the upstream inspections, stoplogs were placed in front of the gates prior to the inspection. The first part of the inspection was a rope access inspection of the bottom seal, bottom of the upstream surface of the skin plate and the hoist connections. During the inspection the gates were opened approximately three feet. At certain gates, the inspection under the bottom of the gate or measurements for racking could not be made due to excessive leakage through the stoplogs and heavy flows on the spillway. Racking measurements were recorded between the bottom seal plate on the gate and the embedded spillway seal. The upstream face of the gates was inspected from the spillway deck as each gate was raised to the full open position.

The second part of the upstream inspection consisted of the transverse, operational measurements at the trunnion, amperage readings while opening and closing, and the inspection of the upstream surface of the skin plate. Measurements were made to determine transverse movement of the trunnion hub versus the trunnion yoke at the initial, full open, and final closed position. During the gate opening, visible corrosion, debris and surface inconsistencies were waterblasted from the gate face for better condition assessment, see Photo 1. Amperage readings for the hoist were recorded at initial opening, during opening and during closing.

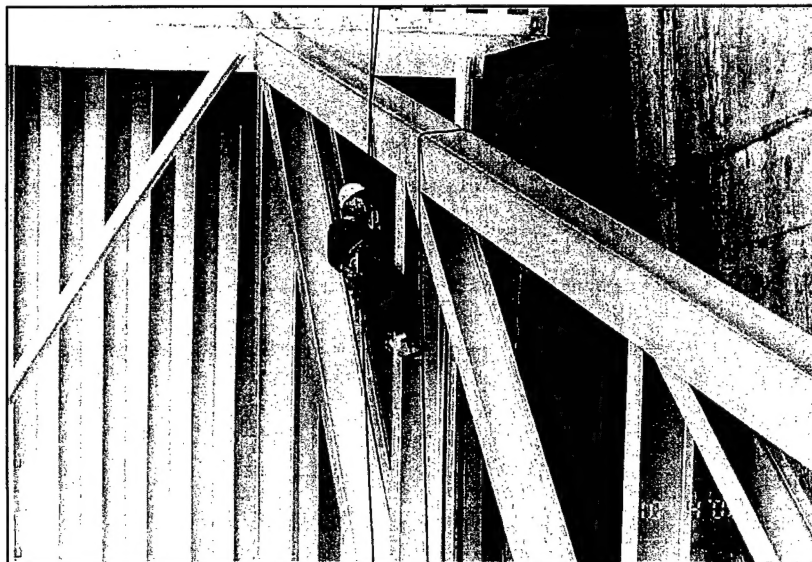
## LOWER GRANITE DAM



**Photo. 1: Waterblasting of upstream surface of skin plate during full opening of gate.**

### Downstream Inspection

The downstream portions of all gates were inspected. The downstream gate members were inspected by climbing along the horizontal girders and radial struts, see Photo. 2. Inspection rigging for the downstream inspections was anchored to the gate hoist equipment and torque tubes. Visual observations were made for excessive sweep and camber of the main struts and were recorded only if an abnormal condition was observed.



**Photo. 2: Rope access downstream inspection.**

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### Operational Testing – Unloaded vs. Loaded

At the completion of the upstream inspection, with the stoplogs in place and the gate unloaded, dial gages were set at the trunnion to measure the vertical, transverse, and lateral movement of the trunnion hub versus the trunnion yoke. After initial readings were taken, the top stoplog was cracked open and the void was flooded, loading the gate. When the void between the stoplogs and the gate was completely full, final movement readings were taken. There was no gap present at the bearing between the trunnion yoke and the trunnion support beam, therefore, movement readings between the two surfaces were not made.



**Photo. 3: Installation of dial gages at trunnion .**

### Operational Testing – Loaded

With the stoplogs removed and the gate fully loaded, the gates were opened to two feet. Amperage reading for the hoists were recorded at the initial opening, during the opening of the gate and during closing.

### Nomenclature

The gates are identified as Gate 1 to 8, with 1 on the south end near the powerhouse looking downstream. Unless noted otherwise, all locations of observations, and notes pertaining to the radial gates are identified as right or left looking downstream.

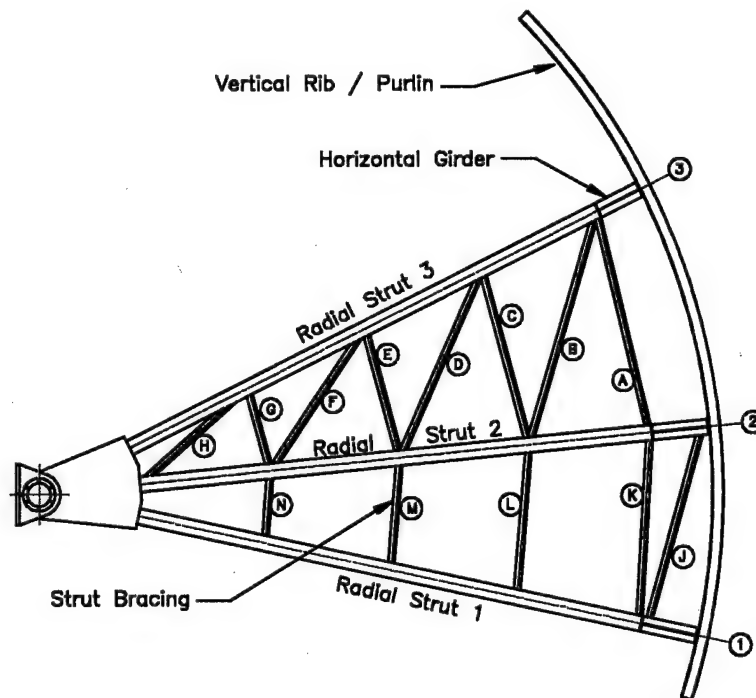
# LOWER GRANITE DAM

In the inspection sheets and this report, corrosion is classified as light, moderate or heavy as follows:

- Light - Surface rust with no flaking or packing. Rust can not be scraped off by hand.
- Moderate - Some flaking, beginning to pack, but thickness of the pack is less than approximately 1/16". There is no observable loss of section.
- Heavy - Pack rust with measurable or observable section loss to the member.

## Member Designations

For the radial gate inspection observations and the photographs, the member designations indicated in Figure 1 apply.



**Figure 1: Radial gate member designations.**

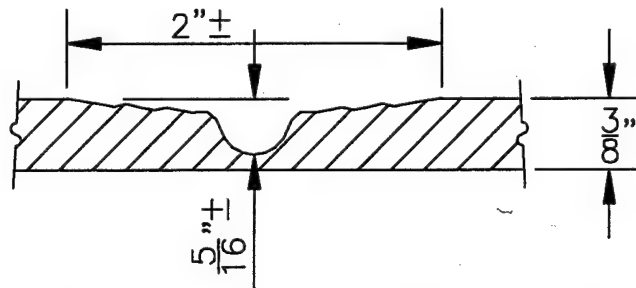
## General Inspection Observations

The majority of condition observations found during the inspection are consistently found at all of the gates. The following section of the report pertains to those general observations or conditions which were found to apply to all of the gates. Specific observations or deficiencies for individual gates begin on page 22. No significant deviations from the as-built plans were observed for the radial gates. Field inspection sheets for the gates are included in Appendix A. Hoist operation and inspection sheets can be found in Appendix B.

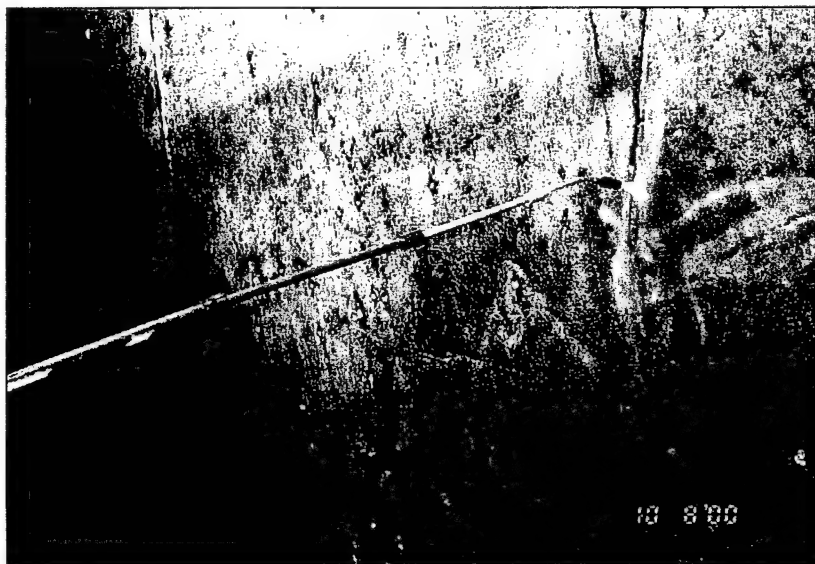
## LOWER GRANITE DAM

### Upstream Surface of Skin Plate

The upstream surface of the skin plate is in extremely poor condition. There is large, scattered pitting on the entire surface of every gate. On average, the pits are approximately two inches in diameter and 1/4-inch to 5/16-inch deep. Many appear to be greater than 1/4-inch deep in the 3/8-inch thick portion of the skin plate and greater the 3/8-inch deep in the 1/2-inch thick portion. See Figure 2, and photos 4 through 7 below. The 3/4-inch thick cable wear plates are in good condition with respect to cable wear, however, there is pitting present in excess of 1/2-inch deep at some locations, see Photo. 8. At many locations the pitting on both the skin plate and wear plates appears to be associated with scratches or dings in the plates original protective coating. Based on the hemispherical shape of the pitting, the corrosion appears to be microbially influenced. It is likely that increased acid levels due to microbial activity have created a concentration cell within the pits and accelerated the corrosion.

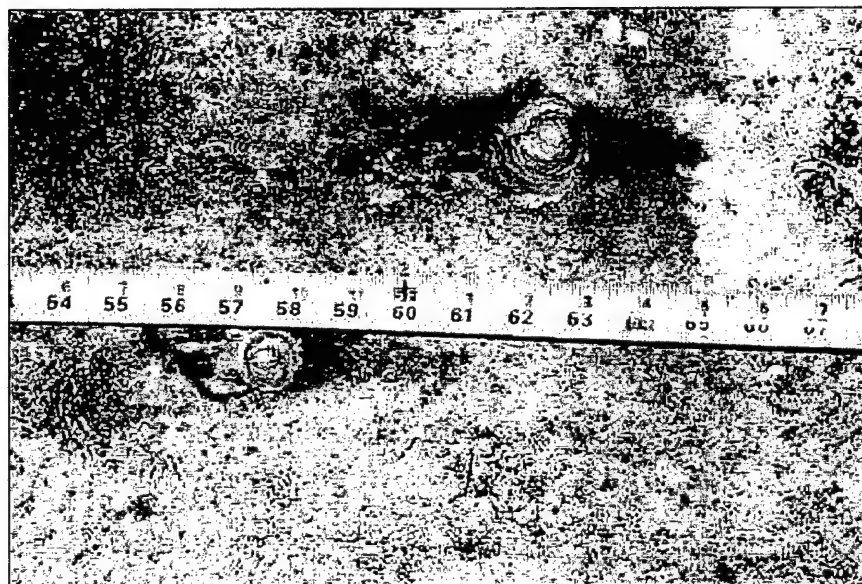


**Figure 2: Typical pitting profile.**

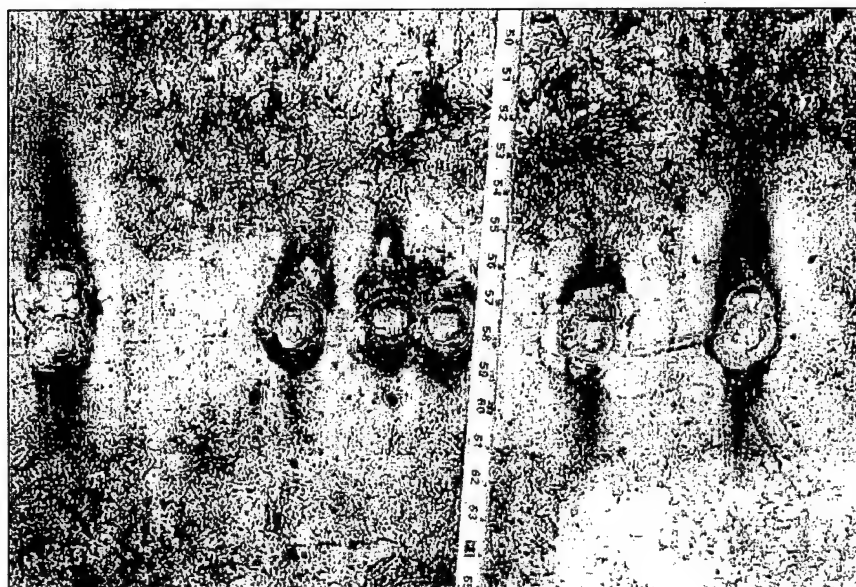


**Photo. 4: Typical distribution of pitting.**



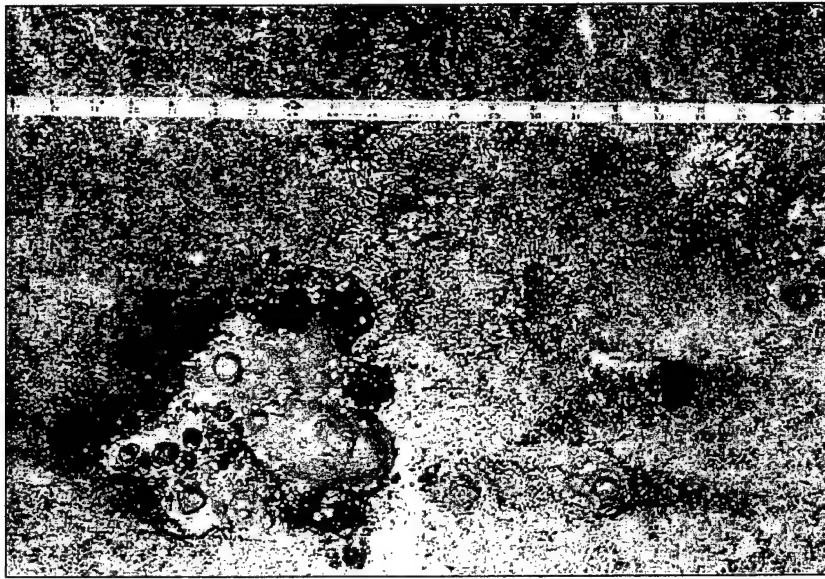


*Photo. 5: Pitting, typical.*

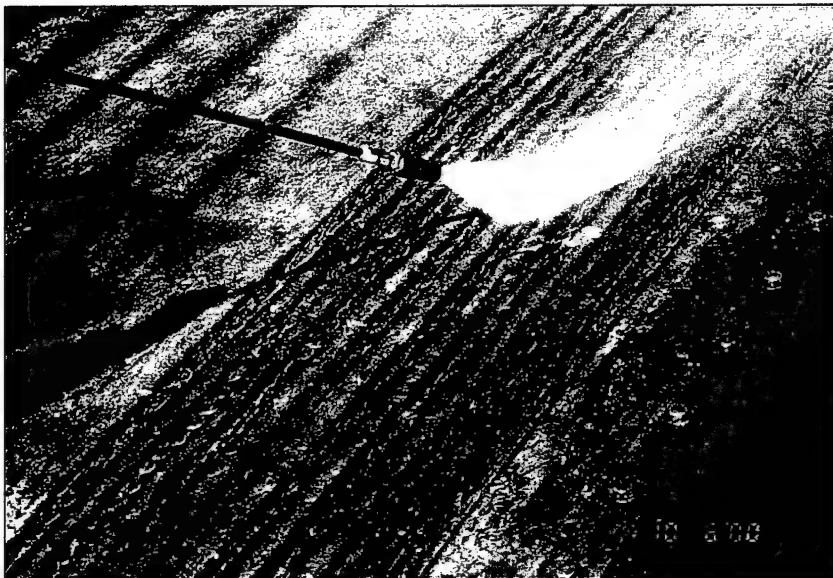


*Photo. 6: Pitting, typical.*

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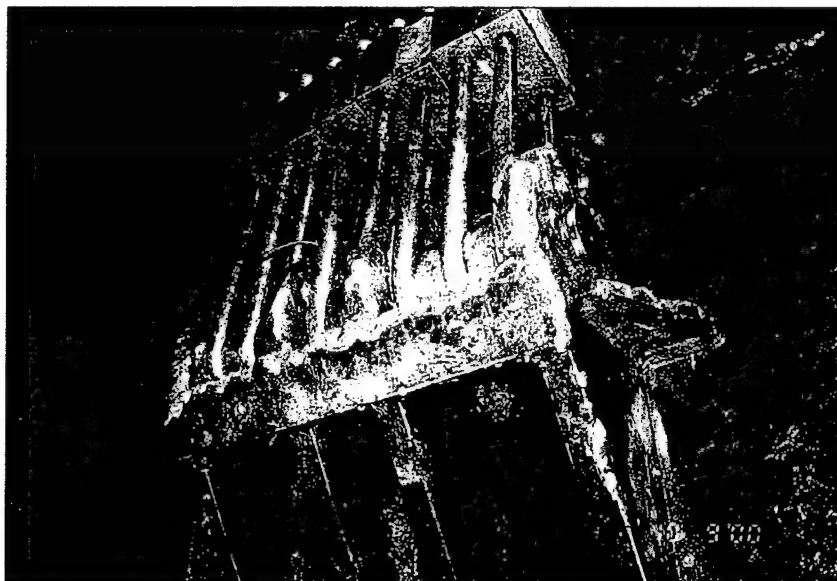
*Photo. 7: Pitting, typical.*



*Photo. 8: Condition of cable wear plates, typical.*

### Hoists Connections

The hoist connections are in generally good condition with light to moderate corrosion present on the lifting lug plates. The U-bolts, socket blocks and connection pin, which appear to be stainless steel, are in very good condition, see Photo. 9. The design or material type for the U-bolts, socket blocks and connection pin are not listed in the available plans.



*Photo. 9: Hoist connection, typical condition.*

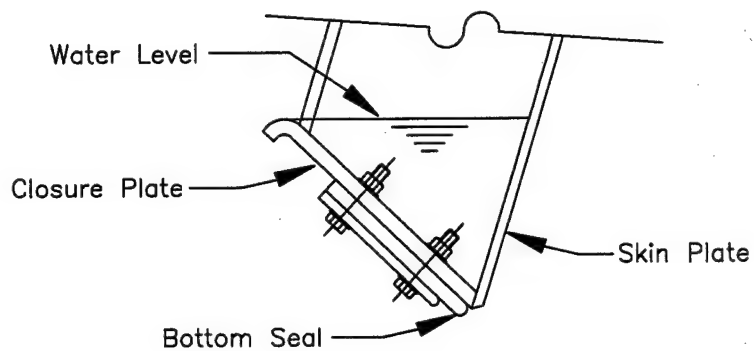
### Downstream Surface of Skin Plate

The downstream surface of the skin plate is in generally good condition. Isolated spots of light surface corrosion and previous (painted over) pitting can be found at various locations.

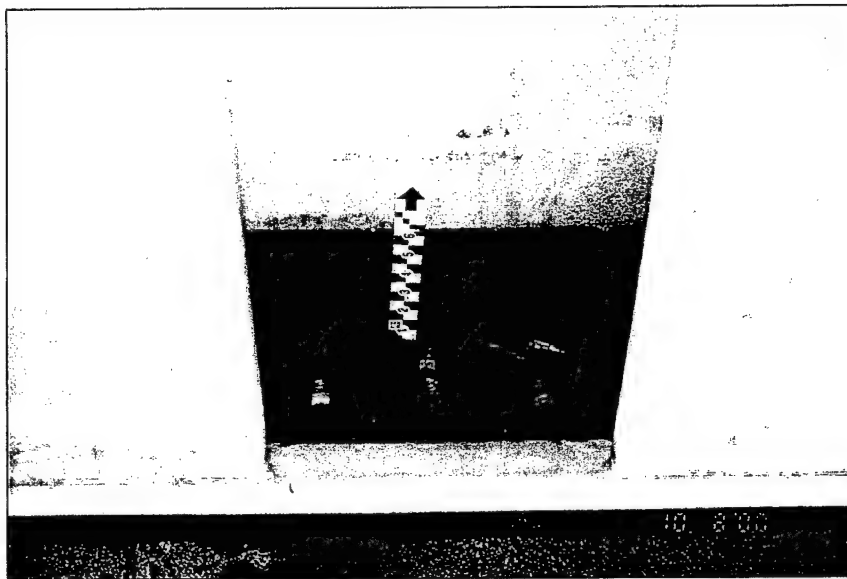
### Vertical Purlins

The vertical purlins are in generally good condition. At the bottom of the gate there is standing water between the bottom seal closure plate, the web of the purlins and the downstream side of the skin plate. Light to moderate corrosion is forming on all surfaces. There is no drainage for this space and it is consistently full of water and debris at all gates, see Figure 3 and Photo. 10.

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**Figure 3: Standing water at bottom of gate between skin plate, purlin webs and bottom seal closure plate, typical.**



**Photo. 10: Standing water at bottom of gate between skin plate, purlin webs and bottom seal closure plate, typical.**

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### Horizontal Girders and Braces

The horizontal girders and bracing are in generally good condition. There are isolated spots of light to moderate corrosion, mostly at locations with poor drainage.

The top and middle horizontal girders are divided into twelve drainage areas due to the web stiffeners. The area at either end of the girders is free to drain off the end of the web. The remaining ten areas have only three drain holes and require water to flow horizontally through at least one notch in the stiffeners in order to reach a drain hole. There are debris lines and evidence of standing water on nearly all of the horizontal girder flanges and webs.

The worst corrosion occurs on the bottom horizontal girder, between the multiple stiffeners, at each end of the girder. There are six stiffeners in close proximity to one another with drainage only provided horizontally through a notch at the upstream (low) end of the stiffener. In order for the last space to drain, the water must travel horizontally under five stiffeners. These notches are typically clogged and the area between the stiffeners is consistently full of water and debris, see Photo. 11.

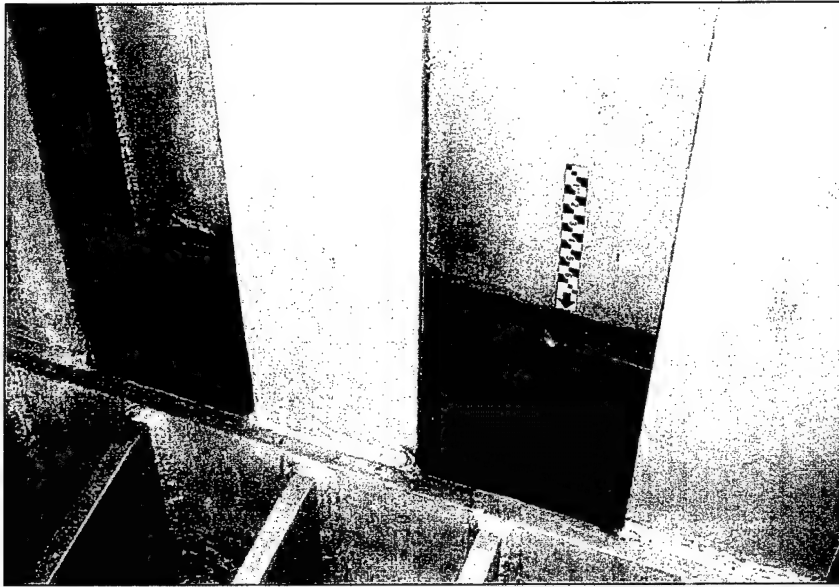


***Photo. 11: Standing water between stiffeners at ends of bottom horizontal girder, typical.***

Immediately upstream and slightly above the end of the bottom horizontal girders, there are stiffeners between the skin plate, purlins and upstream flange of the horizontal girders. There is no drainage from this location and the enclosed area is either full of water and/or debris on all gates. See Photo. 12.



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**Photo. 12: Standing water and debris between purlins, skin plate and upstream horizontal girder flange, typical.**

On the underside of the bottom horizontal girder, at the connection to the radial struts, there is delaminated paint and light to moderate corrosion around the drain hole in the girder web and near the adjacent stiffeners. See Photo. 13.



**Photo. 13: Corrosion beneath bottom horizontal girder. Looking up at girder flange (behind hammer) and stiffener (right), typical.**

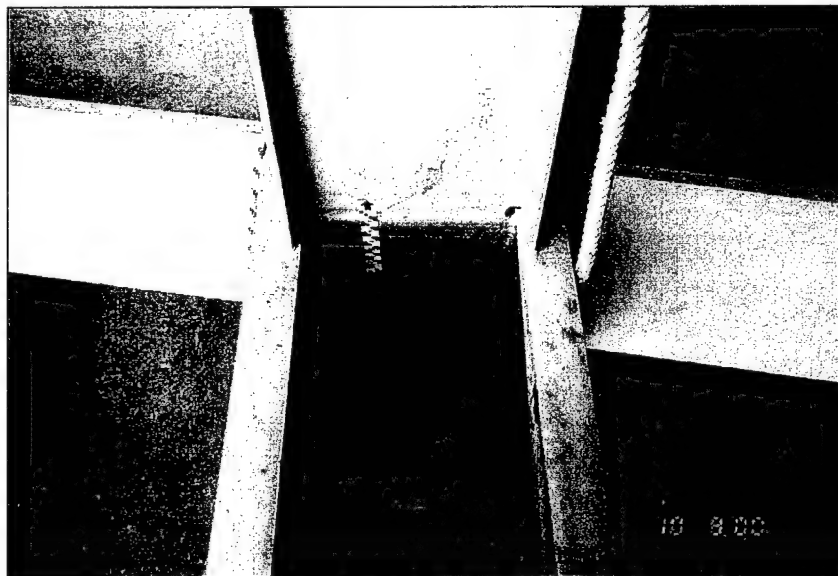
## **LOWER GRANITE DAM**

### **Radial Struts and Braces**

The radial struts are in generally good condition with only light surface corrosion at isolated locations.

There is very poor drainage from the upstream end of the bottom radial strut and ponding or debris lines (evidence of previous ponding) are found at every gate, see Photo. 14.

There is very poor drainage from the downstream end of the top radial strut at the trunnion. The three radial struts become an enclosed box section at the trunnion. Since there is no drainage vertically from between the flanges of the top strut, a small drain hole is provided horizontally through the strut flange. The drain hole is consistently clogged and standing water is present at most trunnions.



***Photo. 14: Standing water at upstream end of bottom radial strut, typical.***

### **Trunnions**

The trunnion hubs, yokes and bearing material are in generally very good condition and appear well lubricated. Lubricant was observed being expelled between the yoke and hub, around the circumference of all of the trunnions.

### **Side and Bottom Seals**

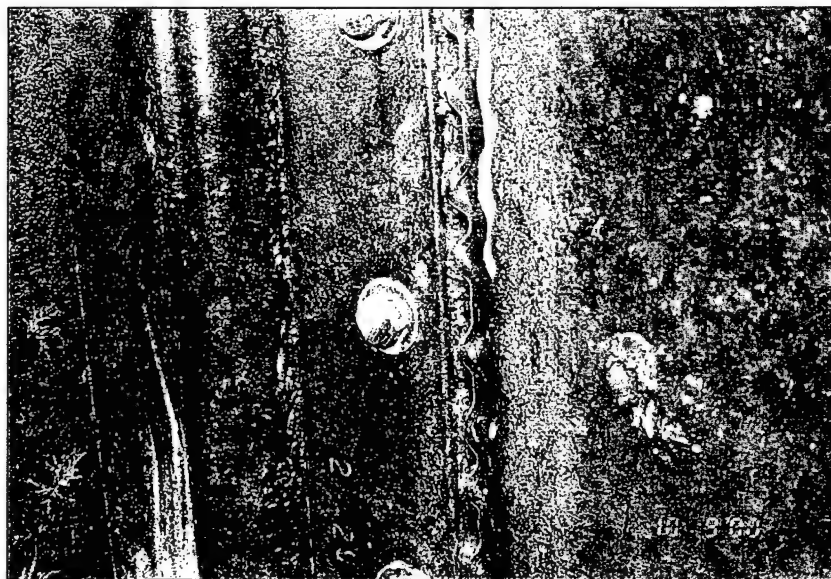
The side and bottom seals are in generally good condition. Small side and bottom seal leaks are visible on many of the gates, although no major leaks were observed. There is a leak at the bottom seal, at the spillway monolith construction joint at nearly every gate. Photo. 15. The

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bottom and side seal material is in good condition with very little cracking or deterioration present.



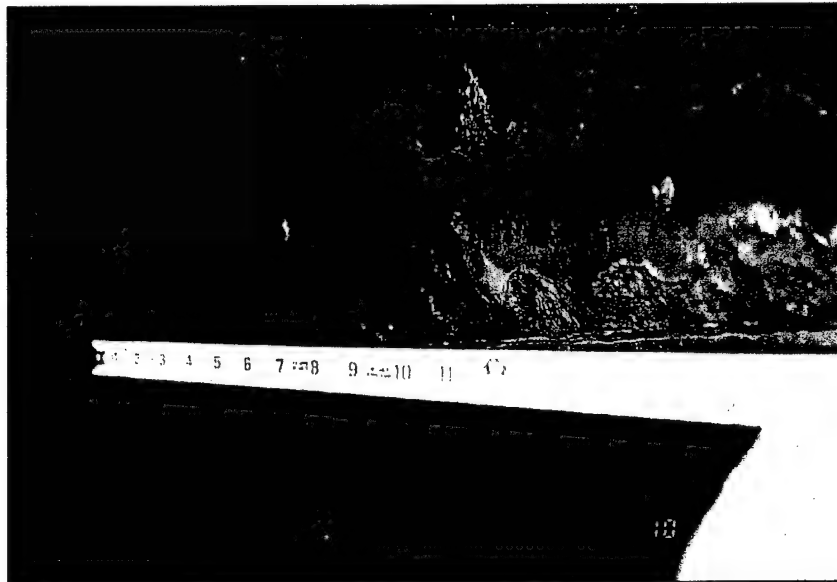
***Photo. 15: Leak at spillway monolith construction joint, typical.***



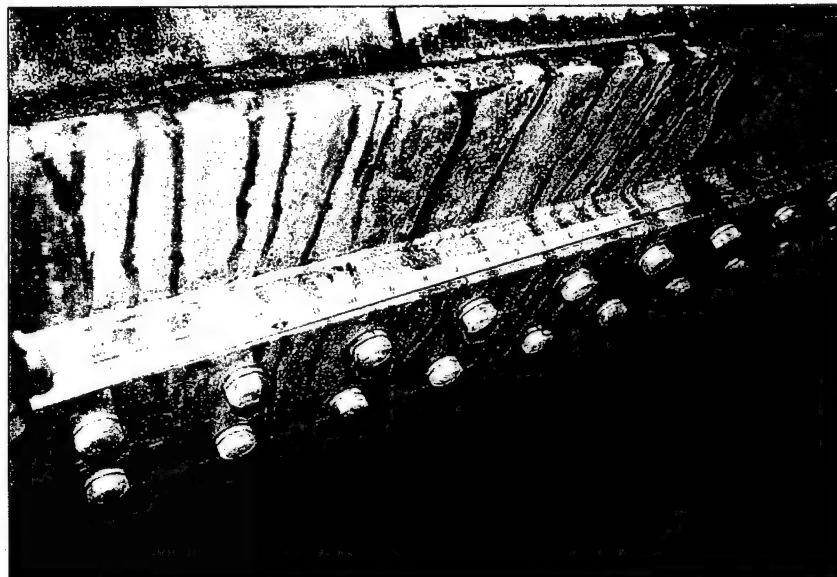
***Photo. 16: Side seal from upstream side with no signs of cracking or deterioration, typical.***

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There is moderate corrosion on the skin plate on the upstream side of the bottom seal. The downstream side of the bottom seal is in good condition with little occurrence of corrosion. See Photo. 17 and Photo. 18.



**Photo. 17: Upstream side of bottom seal with light to moderate corrosion on skin plate, typical.**



**Photo. 18: Downstream side of bottom seal, typical**

## Radial Gate – Operation, Testing and Measurements Member Section Dimensions

Section dimensions of main structural members were measured to verify conformance with the design drawings. These members included radial struts, radial strut bracing, horizontal girders, horizontal girder bracing and purlins. Measured dimensions were recorded on field data sheets found in Appendix A. The data sheets also contain nominal section dimensions from the American Institute of Steel Construction (AISC) *Steel Construction Manual, Seventh Edition, 1970*. Section measurements typically include the depth,  $d$  (measured at the edges of the flanges), the flange width,  $b_f$ , and the flange thickness,  $t_f$ . Web thickness,  $t_w$ , was only measured if there was an exposed portion of the web or drain holes large enough for calipers.

Differences between the design drawings and the actual field conditions of 1/16<sup>th</sup> inch or less were deemed to be insignificant. Nearly all members in the field were found to be greater or equal in dimension than what was required in the design drawings. The larger dimensions were probably due to inaccuracies of the field measurements resulting from difficult access or with the thickness of the paint on the members. Those that were smaller were all within the fabrication tolerances. Of those measurements that were out of fabrication tolerance range, none were consistently out of range to conclude that a member other than what was specified in the design drawings was used.

## Racking Measurements

Racking measurements for the gates were made at the beginning of the upstream inspection of the gates. Measurements were recorded for the distance between the bottom of the gate at the bottom corner of the bottom seal plate, and the embedded spillway plate. Measurements were made as far as possible to the left and right side of the gate depending on stoplog leakage and flow on the spillway. The gates were typically between two and three feet open when the measurements were made. The measurements for racking are as follows:

	Left (inches)	Right (inches)
Gate 1	-	-
Gate 2	35 - 3/4	36 - 1/2
Gate 3	47	47
Gate 4	14 - 1/2	14 - 3/4
Gate 5	24 - 3/4	24 - 3/4
Gate 6	30 - 1/4	30 - 1/4
Gate 7	24 - 3/4	24 - 3/4
Gate 8	26	25 - 3/8

**Table 2: Gate racking measurements.**



## LOWER GRANITE DAM

The gates were also observed at the moment of first opening to look for signs of water release beginning from one side of the gate or the other. In most cases, water release would begin at both sides of the gate simultaneously and move towards the middle of the gate at equal rates. Based on the recorded measurements and observations, there is no apparent racking of the gates.

### Trunnion Hub Movement: Closed - Full Open - Closed

With the stoplogs in place, measurements were made of the transverse gap between the trunnion hub and the trunnion yoke at both trunnions. The measurements were made with the gate at the initial opening, full open, and again when closed. The maximum transverse movement recorded between any two positions is as follows:

	Left Trunnion		Right Trunnion	
	Inside (inches)	Pier Side (inches)	Inside (inches)	Pier Side (inches)
Gate 1	0	0	0	0
Gate 2	1/32	0	1/32	0
Gate 3	0	0	0	0
Gate 4	0	0	0	0
Gate 5	1/16	0	0	0
Gate 6	0	0	1/32	0
Gate 7	0	0	0	0
Gate 8	0	0	0	0

**Table 3: Transverse trunnion hub movement through full opening and closing**

Based on the surface irregularities of the trunnion hub and the casting tolerances, the transverse measurements between the hub and the yoke can only be considered accurate to  $\pm 1/16$ -inch. The recorded measurements indicate there is no appreciable lateral movement of the trunnion hubs with respect to the trunnion yoke during either opening or closing of the gate.

## LOWER GRANITE DAM

### Trunnion Hub Movement: Unloaded vs. Loaded

Dial gages were installed at one trunnion to record the vertical, transverse and upstream / downstream movement of the trunnion hub with respect to the trunnion yoke. The initial measurement was made with the stoplogs in place and no load on the gate. The final reading was made after the top stoplog was removed and the gate was fully loaded. The maximum movements recorded at the trunnion hubs are as follows:

	Vertical (1 / 1000 inch)	Upstream / Downstream (1 / 1000 inch)	Transverse (1 / 1000 inch)
Gate 1	4	25	0
Gate 2	2	39	33
Gate 3	4	29	10
Gate 4	2	33	0
Gate 5	16	54	18
Gate 6	9	36	6
Gate 7	6	35	2
Gate 8	3	25	9

**Table 4: Loaded versus unloaded trunnion movements**

For the vertical movements shown in Table 4, the hub moved upward with respect to the yoke during loading. The upstream / downstream movement of the hub was in the downstream direction and the transverse movement was outward, toward the piers.

The tolerance for the 24-inch diameter trunnion pin is listed in the design plans as +0.000 inches and -0.005 inches. The tolerances for the 24-inch diameter trunnion bushing is listed as +0.012 inches and -0.000 inches. The shop plans for the pin indicate the pin should be 23.980 inches in diameter with tolerances of +0.000 inches and -0.008 inches.

Based on the tolerances listed either in the design plans or the shop plans, there is no significant displacements of the trunnion hub with respect to the trunnion yoke occurring during the loading or opening process.

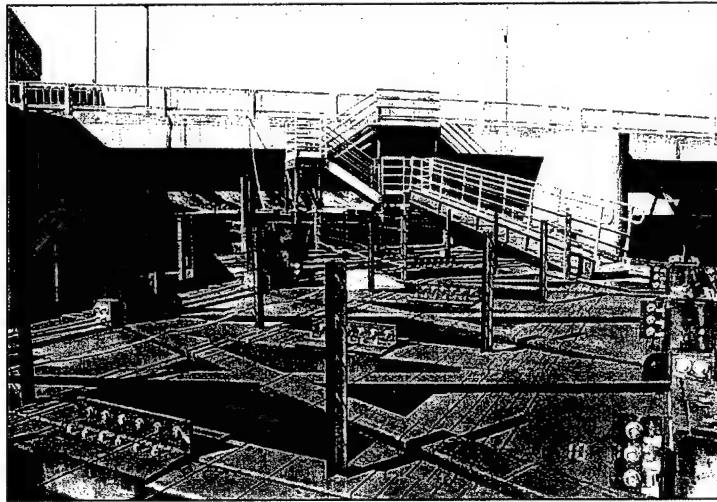
## LOWER GRANITE DAM

### Individual Gate Inspection Observations

The observations in the following section pertain only to the gates indicated and were not typically found on all of the gates.

#### Gate 1

- Due to the presence of the surface collector installed in the stoplog slots at Gate 1, the upstream inspection and operational tests were not performed until November 20th, see Photo. 19. The upstream surface of the skin plate was in generally the same condition as the previously inspected gates.



**Photo. 19: Surface collector installed at Gate 1 during initial inspection.**

## **LOWER GRANITE DAM**

### **Gate 2**

- Flange and web at the top left vertical brace at connection to middle girder is deformed. The web is deformed toward the middle of the gate approximately 1 inch. See Photo. 20 and Photo. 21.



***Photo. 20: 1 inch deflection in web of top left vertical brace at middle girder.***

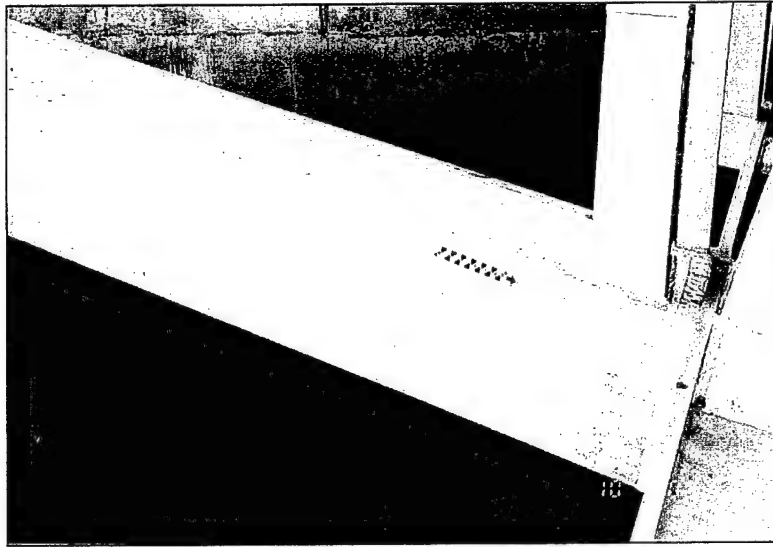


***Photo. 21: 1/4 inch deflection in flange of top left vertical brace middle girder.***

## LOWER GRANITE DAM

### Gate 3

- At the upstream end of the bottom right radial strut there are indentations on the outside surface of the inside (spillway side) flange. The indentations appear to be due to previous grinding which occurred prior to the most recent painting. See Photo. 22



***Photo. 22: Grinding marks on lower strut flange.***

- There appears to be a small lubrication leak in the lubrication line to the right (looking downstream trunnion). There is a bulge of lubricant at the angle coupling between the flexible line and the trunnion hub. See Photo. 23.



***Photo. 23: Lubricant bulb at connection to trunnion.***

## LOWER GRANITE DAM

### Gate 4

- Prior to the inspection of the upstream face of the gate and waterblasting, an approximately 10-inch diameter paint blister was observed on the downstream side of the skin plate. The blister was located between the middle and top horizontal girders, approximately 7-feet from the left side of the gate (looking downstream) and approximately 6-feet above the transition between the 1/2-inch and 3/8-inch skin plate. The blister did not appear to be leaking water at the time, however, rust stains were observed on and beneath the blister. After waterblasting the upstream surface of the gate, the blister developed several leaks, see Photo. 24 and Photo 25. During the downstream inspection of the gate the blistered paint was removed to expose the hole in the skin plate, see Photo 26. The actual hole through the skin plate was roughly oblong and approximately 1/4-inch wide and 1/8-inch tall.
- The leak was patched by Gus Hernandez, USACE, on October 17th using META-LOX™ Industrial-Grade Metallic Patching Compound, a 2-part epoxy and resin compound.



**Photo. 24: Paint blister and leakage downstream side of skin plate, prior to removal of paint.**

## LOWER GRANITE DAM



**Photo. 25: Skin plate leak  
prior to removal of  
paint.**



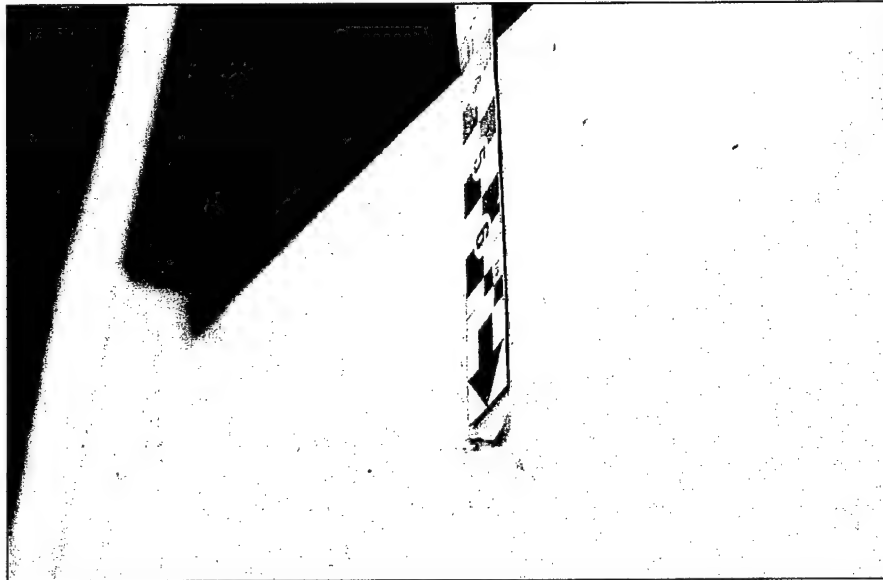
**Photo. 26: Skin plate leak  
after removal of  
paint.**



## **LOWER GRANITE DAM**

### **Gate 5**

- There is a indentation in radial strut brace H on the right side frame. The indentation is approximately 2 inches long, ½ inch wide, and ¼ inch deep. The indentation appears old and probably occurred during construction. There is no sign of distress or corrosion associated with it, see Photo. 27.



***Photo. 27: Deformation in Brace H.***

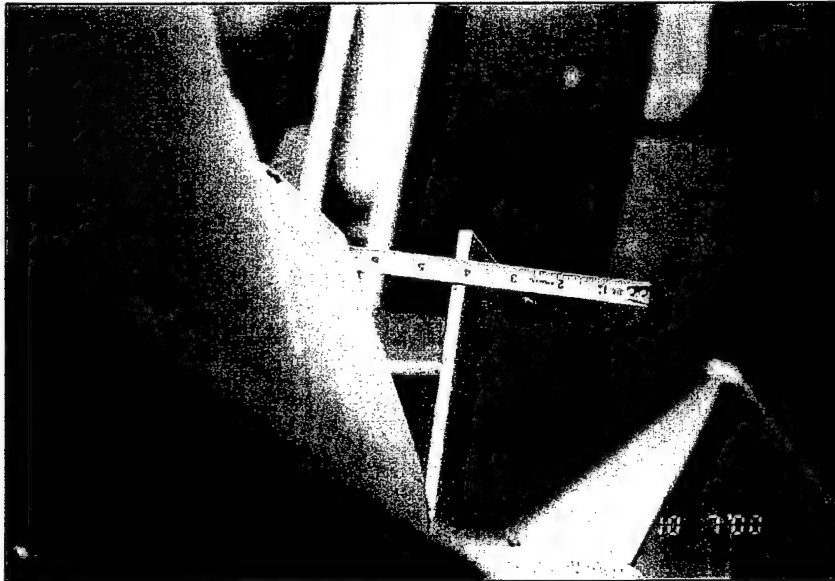
### **Gate 6**

- See general condition observations.

## LOWER GRANITE DAM

### Gate 7

- The web of the top right vertical bracing at connection to middle girder is deformed. The web is deformed towards the middle of the gate approximately 2 inches. This is similar to deformation on Gate 2. See Photo. 28.



***Photo. 28: 2 inch deflection in top right vertical bracing at middle girder.***

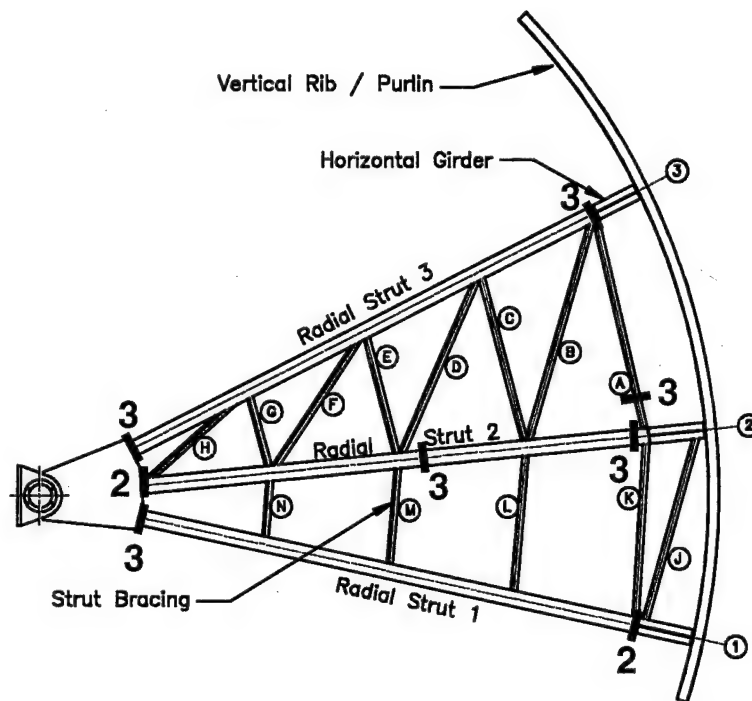
### Gate 8

- See general condition observations.

## Ultrasonic Testing Results

### Description

The field welds on the gates were tested ultrasonically to determine the amount of discontinuity present and the integrity of the welds. The location of the tested welds is shown in Figure 4.



**Figure 4: Ultrasonic Weld Test Locations.**

A total of 352 welds were tested, of which 54 welds were rejected in accordance with the requirements of ANSI / AASHTO / AWS D1.5, 1995 Bridge Welding Code. Of the welds which failed the testing, 69% were located at the upstream end of the radial struts. Only one weld at the connection between the downstream end of the radial struts and the trunnions was found to fail the testing.

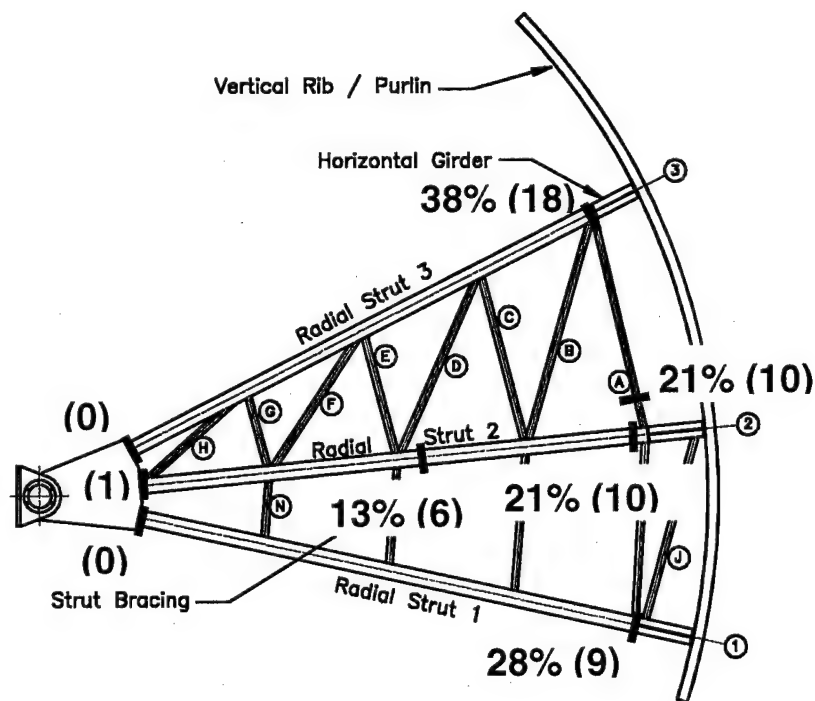
Table 5 lists the rejected welds by gate number and location on the gate. The letter 'f' indicates a flange weld, 'w' a web weld. Approximately 75% of the rejected welds were located on the flanges of the members. Figure 5 illustrates the percentage of welds which failed testing and the total number of welds which failed for each location tested.

The extent and depth of the rejected welds are marked on each of the tested welds in the field. At each rejected weld there will be a start and end mark along the weld and a number indicating the depth of the flaw. For individual gate weld test sheets, see Appendix C.

# LOWER GRANITE DAM

Gate	Welds Accepted	Welds Rejected	Flaw Severity Class				Locations
			A	B	C	D	
1	41	3	1	2	0	0	33w, 34f, 35f
2	42	2	2	0	0	0	58fo, 59fo
3	37	7	6	1	0	0	25f, 26f, 27f, 28f, 29f, 30f, 31w
4	27	17	12	2	0	3	36w, 37fo, 38fi, 39fi, 40fi, 42fo, 43w, 44fi, 45w, 36fo, 47fi, 48w, 49fo, 50fo,
5	41	3	3	0	0	0	78fi, 79fi, 80fi
6	41	3	2	1	0	0	60fo, 61fo, 62fi
7	29	15	15	0	0	0	63fo, 64fo, 65fi, 66w, 67fi, 68fi, 69w, 70fo, 71fi, 72fo, 73fi, 74w, 75fo, 76w,
8	40	4	4	0	0	0	54, 55w, 56fi, 57w

**Table 5: Ultrasonic Testing Summary.**

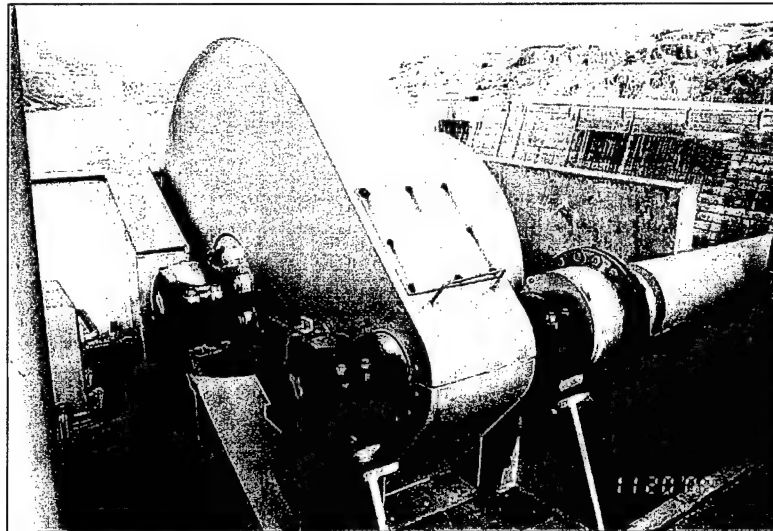


**Figure 5: Ultrasonic Weld Test Locations and Percentage of Welds Failing Testing at Each Location.**

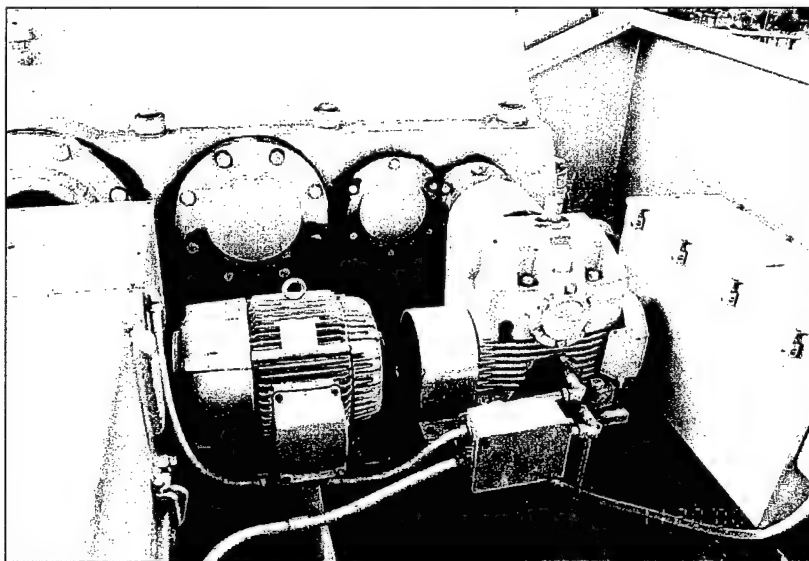
## Hoists – Operation, Testing and Measurements

### Hoist Operation Inspection

External portions of the hoist equipment, support platforms and gate connections were visually inspected for signs of excessive corrosion, wear or damage. See Photos 29, 30 and 31 below. The hoist and hoist machinery are in generally good condition.



*Photo. 29: Hoist, typical.*



*Photo. 30: Hoist motors, typical.*

## LOWER GRANITE DAM



*Photo 31: Hoist manufactures plate, typical.*

The following observations were made at individual gate hoists:

	Hoist and Motor Observations
Gate 1	Loaded test only performed due to surface collector.
Gate 2	There is a high level of noise from the right angle gearbox. The coupling should be checked and lubricated.
Gate 3	Right angle gearbox - high level of noise -check coupling and lube. Main gearbox has severe oil leak at output shaft.
Gate 4	There is bearing noise at the motor output shaft. The main gearbox shaft seals are weeping.
Gate 5	The main gearbox output shaft seals are leaking.
Gate 6	The main gearbox seals are weeping.
Gate 7	The main gearbox seals are weeping.
Gate 8	The main gearbox seals are weeping.

**Table 6: Hoist operation observations.**

## LOWER GRANITE DAM

### Hoist Amperage Measurements:

Hoist amperage readings were recorded during opening and closing of the gates in both the loaded and unloaded condition. The readings include the start up and running amperage. Running amperages were recorded for Phase A, B and C. Table 7 lists the opening and closing start up amperage and the average of the three phases for the running amperage for the gates in the unloaded condition. Table 8 lists the same information for the loaded condition.

	Start up Opening	Start up Closing	Running Opening	Running Closing
Gate 1	No unloaded test performed due to surface collector			
Gate 2	106.0	102.0	13.5	9.0
Gate 3	114.4	111.2	15.6	10.6
Gate 4	112.0	105.0	15.9	10.2
Gate 5	115.0	111.2	14.5	10.2
Gate 6	110.5	110.0	15.5	9.9
Gate 7	124.1	110.0	15.8	9.4
Gate 8	110.4	110.6	15.3	10.3

**Table 7: Unloaded Gate - Hoist Amperage Readings**

	Start up Opening	Start up Closing	Running Opening	Running Closing
Gate 1	112.0	110.0	16.0	9.4
Gate 2	108.0	104.5	15.3	9.9
Gate 3	117.6	114.4	16.3	10.1
Gate 4	116.2	104.8	15.7	9.6
Gate 5	108.8	112.0	15.9	10.1
Gate 6	113.6	106.4	15.7	10.2
Gate 7	116.8	110.8	15.5	9.9
Gate 8	114.0	108.0	15.7	10.0

**Table 8: Loaded Gate - Hoist Amperage Readings**

Based on the consistency of the readings the hoists are in generally good condition. The amperage data indicates that the tainter gate hoist motors are operating well within their design operating limits that normally allow the starting amperage to be in the range of 5 to 8 times the nameplate value. The current draw for all motors were in acceptable range and the gates appeared to be free with no apparent binding. The field inspection sheets for the hoist measurements can be found in Appendix B.



### **RECOMMENDATIONS**

#### **Recommended in the next year or as necessary:**

- Repair pitting on skin plate and repaint (or recoat) upstream surface of gate face.
- Install sacrificial anodes on upstream side of gate. Based on the condition of the skin plate at Little Goose Dam (which has sacrificial anodes) sacrificial anodes will significantly reduce the amount and severity of pitting of the skin plate. A corrosion expert should be consulted to determine the number and location of anodes required.

These repairs can be undertaken sequentially on all of the gates at once or the repairs could be made on an as-needed basis as the pitting penetrates the skin plate and leaks develop at individual gates.

#### **Recommended in the next 2 years:**

- Perform a structural analysis of the gates to determine capacity for trunnion friction, operating loads and the demand on the welded joints which were found to contain flaws.
- Analyze the hoist gearboxes per the manufactures recommendation and remanufacture or replace as required.
- Replace the main gearbox seals on the hoist motors.

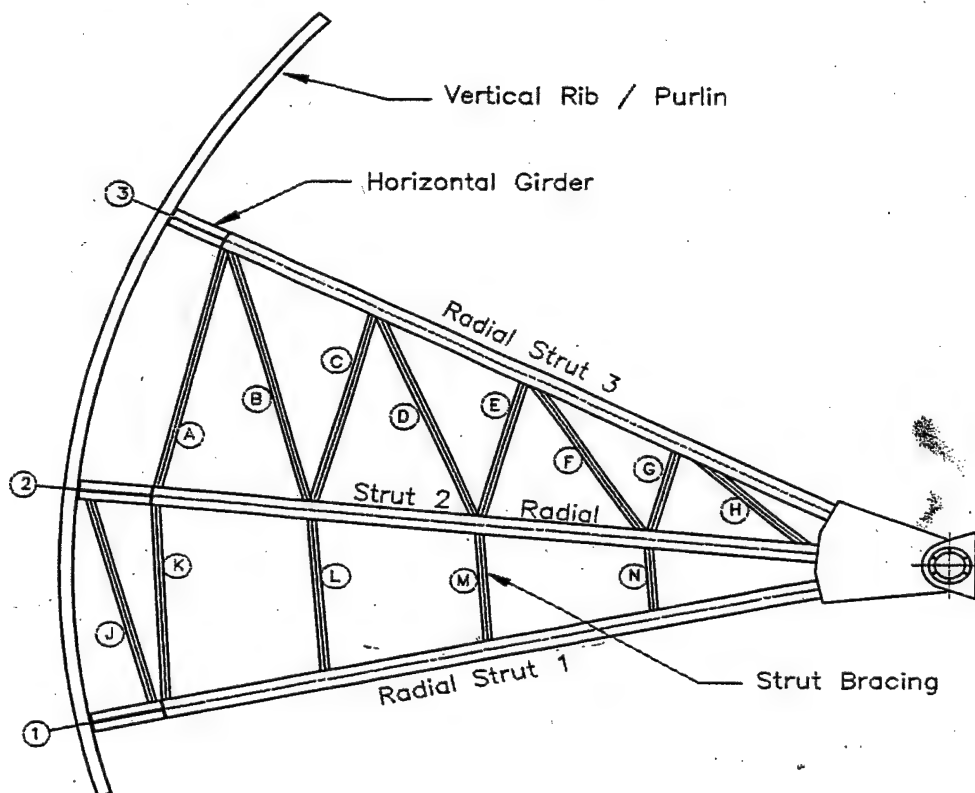
#### **Recommended in the next 5 years:**

- Install drain hole between the multiple stiffeners at ends of the bottom horizontal girders. The recommended size for these drain holes is 1-inch in diameter.
- Install drain holes in the purlin stiffeners near the ends of the bottom horizontal girders (Plate perpendicular to skin plate, above multiple stiffeners on bottom horizontal girder). The recommended size for these drain holes is 1-inch in diameter.
- Install drain holes in the downstream portion of the bottom seal plate between every purlin. Note: the rubber bottom seal is located between the bottom seal plate and the bottom seal keeper plate. The hole should not be flame cut with the rubber bottom seal in place. The recommended size for these drain holes is 1-inch in diameter.
- Enlarge the drain holes at upstream end of lower radial struts. The recommended size for these drain holes is 1 1/2 - inch in diameter.
- For all new and enlarged drain holes, the holes should be drilled, not flame cut, to reduce jagged edges which snag debris. If drilling holes is not feasible, then the edges of the flame cut holes should be reamed smooth.

## **REFERENCES**

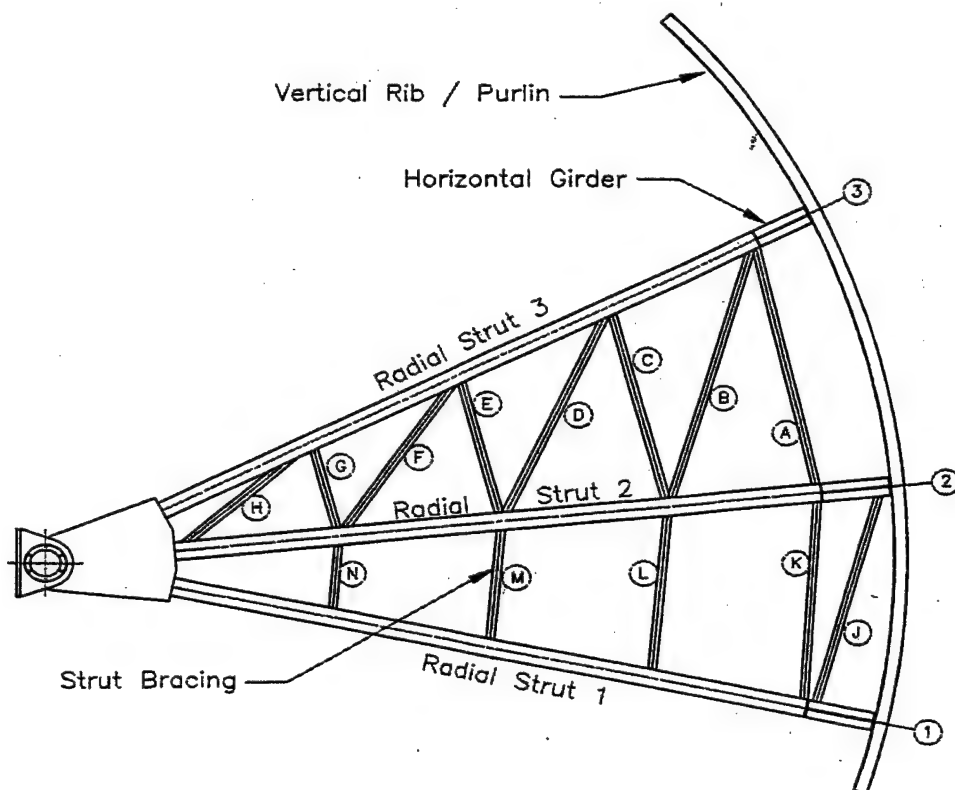
1. Water Control Manual, Lower Granite Lock and Dam, U.S. Army Corps of Engineers, Walla Walla District, May 1987.
2. Lower Granite Lock and Dam, Operations Manual, SCM Consultants , Inc.

Gate No. 1  
Left Elevation B-B



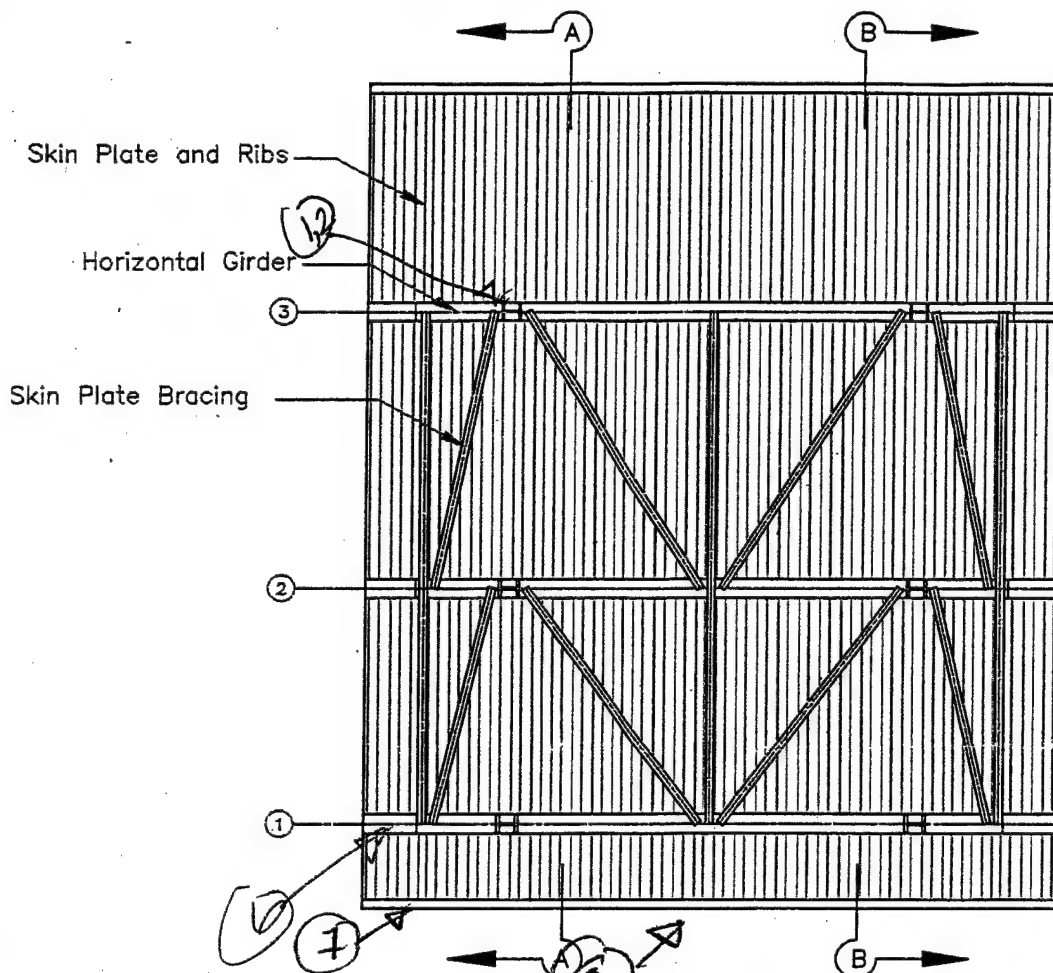
Member	Type	Depth d		Web t <sub>w</sub>		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 5/8	15/16	15/16	15 3/4	✓	1 1/2	✓
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16	1 9/16	16 3/8	✓	2 7/16	✓
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16	1 13/16	16 5/8	✓	2 13/16	✓
Brace A	14 WF 30	13 7/8	13 3/4	5/16	5/16	6 3/4	✓	3/8	✓
Brace B	14 WF 30	13 7/8	13 3/4	5/16	5/16	6 3/4	✓	3/8	✓
Brace C	14 WF 30	13 7/8	13 3/4	5/16	5/16	6 3/4	✓	3/8	✓
Brace D	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	✓	3/8	✓
Brace E	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	✓	3/8	✓
Brace F	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	✓	3/8	✓
Brace G	14 WF 30	13 7/8	✓	5/16	5/16	6 3/4	✓	3/8	✓
Brace H	14 WF 30	13 7/8	14 3/16	5/16	5/16	6 3/4	✓	3/8	✓
Brace J	14 WF 30	13 7/8	✓	5/16	5/16	6 3/4	✓	3/8	✓
Brace K	14 WF 30	13 7/8	13 3/4	5/16	5/16	6 3/4	✓	3/8	✓
Brace L	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	✓	3/8	✓
Brace M	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	✓	3/8	✓
Brace N	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	✓	3/8	✓

Gate No. 1  
Right Elevation A-A



Member	Type	Depth d		Web t <sub>w</sub>		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 3/8	15/16	—	15 3/4	15 3/4	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16	—	16 3/8	16 3/8	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16	—	16 5/8	16 5/8	2 13/16	2 7/8
Brace A	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 3/4	3/8	3/8
Brace B	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 3/4	3/8	3/8
Brace C	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 3/4	3/8	3/8
Brace D	14 WF 30	13 7/8	13 3/4	5/16	—	6 3/4	6 3/4	3/8	3/8
Brace E	14 WF 30	13 7/8	14 1/8	5/16	—	6 3/4	6 7/8	3/8	3/8
Brace F	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	3/8
Brace G	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	3/8
Brace H	14 WF 30	13 7/8	14 1/8	5/16	—	6 3/4	6 7/8	3/8	3/8
Brace J	14 WF 30	13 7/8	✓	5/16	—	6 3/4	✓	3/8	3/8
Brace K	14 WF 30	13 7/8	✓	5/16	—	6 3/4	✓	3/8	3/8
Brace L	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	3/8
Brace M	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	3/8
Brace N	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	3/8

Gate No. 1 Downstream Elevation



① leaking Gate @ Bottom ②

Member	Type	Depth		Web		Flange - End			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Horiz. Girder 3	PL Girder	49 3/4	✓	7/16	✓	16	✓	7/8	✓
Horiz. Girder 2	PL Girder	60 1/2	✓	3/4	5/8	16 1/2	✓	1 1/4	✓
Horiz. Girder 1	PL Girder	60 1/2	✓	1	✓	16 1/2	✓	1 1/4	✓
Purlins	ST 10 WF 31	10 1/2	✓	13/32	✓	8 1/4	✓	5/8	✓
Skin PL Bracing	ST 7 WF 15	7	10 7/8	1/4	✓	6 3/4	✓	3/8	✓

① Corrosion due to standing water

② Corrosion between splice plates due to water

③ Leak in 1. side seal

④ Corrosion in 2nd Girder

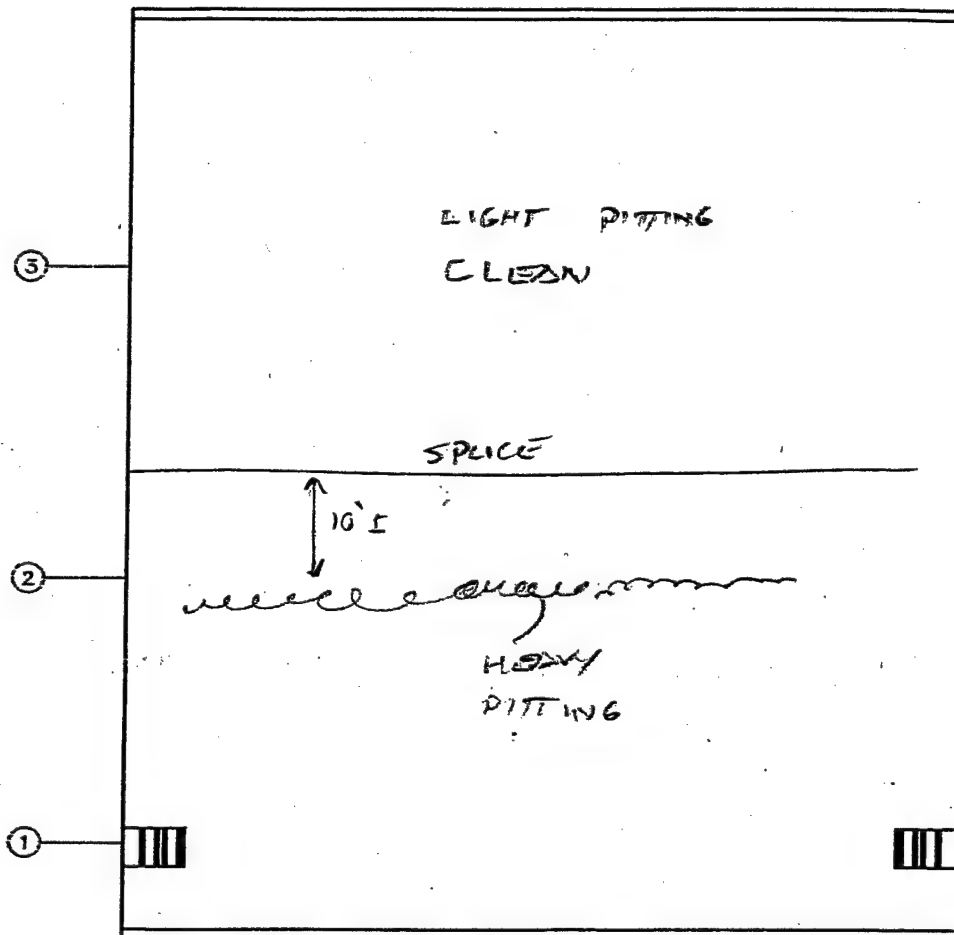
⑤ Ponding water on bottom strut to bottom girder

⑥ Bottom Girder, left

⑦ Standing Water @ Purlins

⑧ Center @ Gate Missing concrete at Bottom Plate

Gate No. 1 Upstream Elevation



HEAVY PITTING @ 10' BELOW SPICE / TOP OF OTHER GATES

Gate No. 1 Operation and Trunnion Measurements

Racking Measurements: Bottom of Gate and Spillway

LEFT	RIGHT

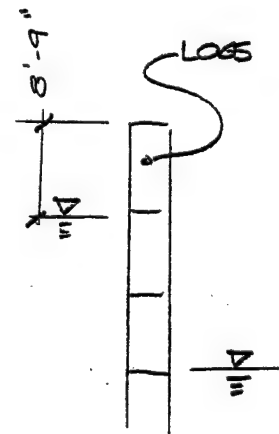
TOO MUCH LEAK  
AND FLOW FROM  
STOPLOGS TO  
MEASURE

Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	22/32	16/32	21/32	14/32
Gate Full Open	22/32	16/32	21/32	14/32
Final Gate Closed	22/32	16/32	21/32	14/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical	0.0000		+0.0035		0.0000		0.0000	
US / DS	+0.0015		+0.0260		+0.0010		+0.0185	
Transverse	22/32	16/32	22/32	16/32	21/32	14/32	21/32	14/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside

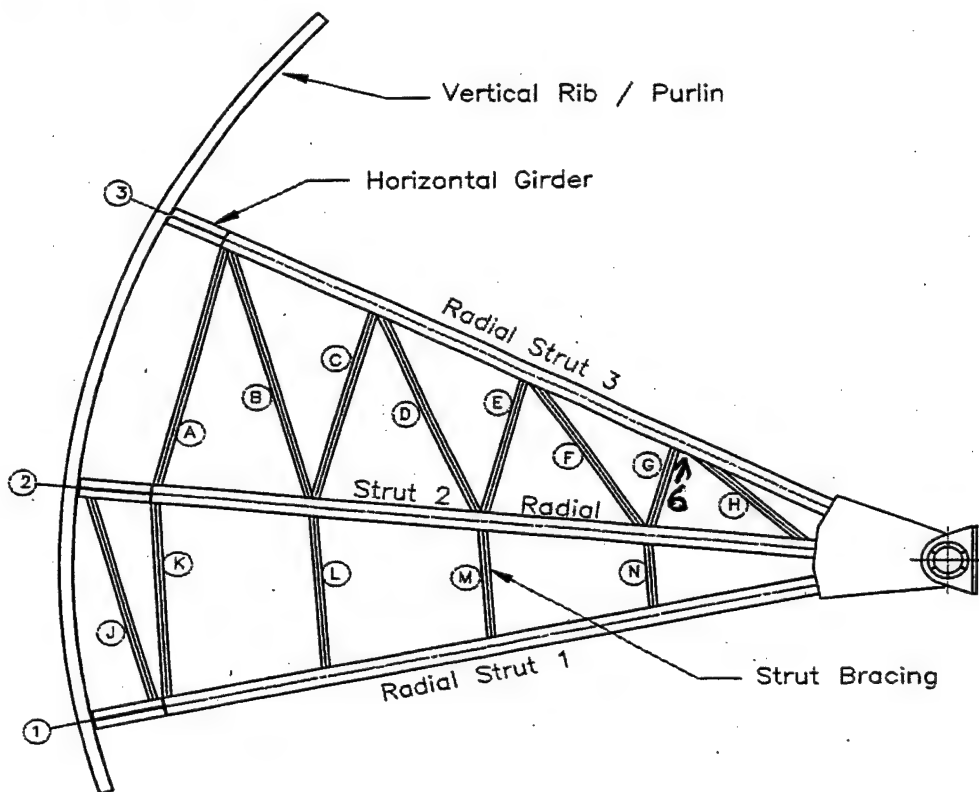


GATE IS SHIFTED TO RIGHT AT FACE

CRANE NOT AVAILABLE, VOID FILLED VIA GRAVITY, NOT FULL  
WHEN MEASURED ≈ 3 LOGS SHOWING



Gate No. 2  
Left Elevation B-B



Member	Type	Depth d		Web t <sub>w</sub>		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 3/4	15/16		15 3/4	15 3/4	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 5/8	1 9/16		16 3/8	16 3/16	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16		16 5/8	16 5/8	2 13/16	2 3/16
Brace A	14 WF 30	13 7/8	14	5/16		6 3/4	6 3/16	3/8	3/8
Brace B	14 WF 30	13 7/8	14	5/16		6 3/4	6 3/4	3/8	3/8
Brace C	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace D	14 WF 30	13 7/8	14	5/16		6 3/4	6 13/16	3/8	3/8
Brace E	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace F	14 WF 30	13 7/8	14	5/16		6 3/4	6 13/16	3/8	3/8
Brace G	14 WF 30	13 7/8	14	5/16		6 3/4		3/8	
Brace H	14 WF 30	13 7/8	14	5/16		6 3/4		3/8	
Brace J	14 WF 30	13 7/8	14	5/16		6 3/4	6 13/16	3/8	3/8
Brace K	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace N	14 WF 30	13 7/8	13 5/16	5/16		6 3/4	6 3/4	3/8	3/8

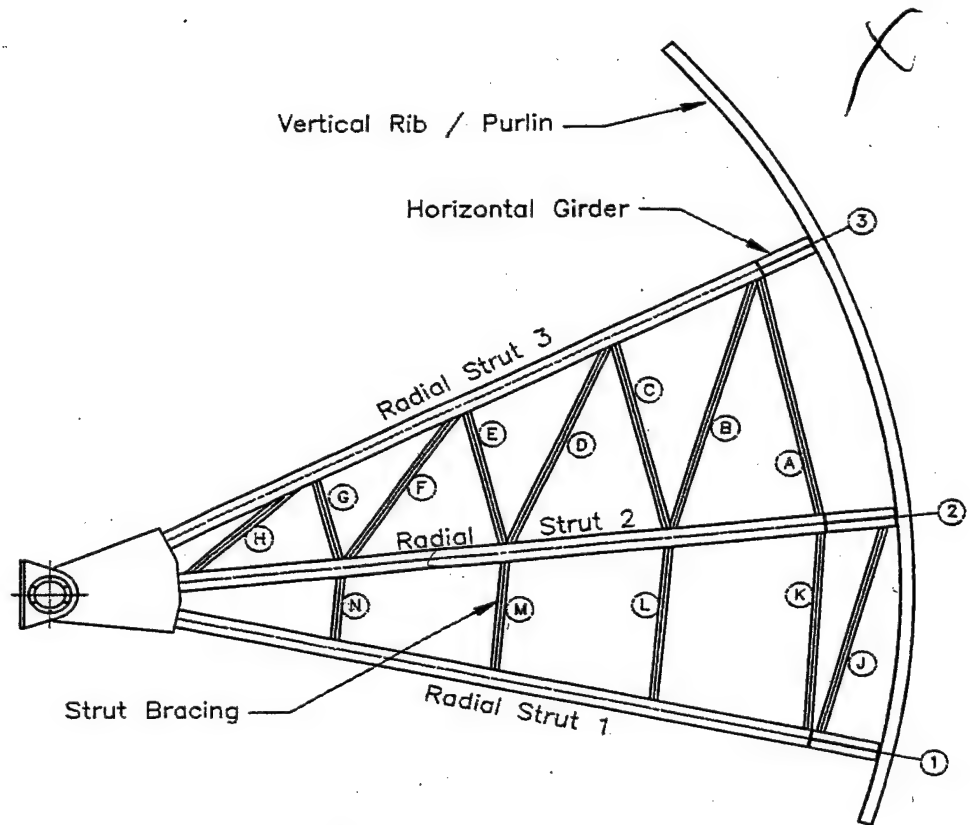
6. Weld cut hole in top Strut.

18. RT. Trunnion

17. OVERALL GATE Pic.

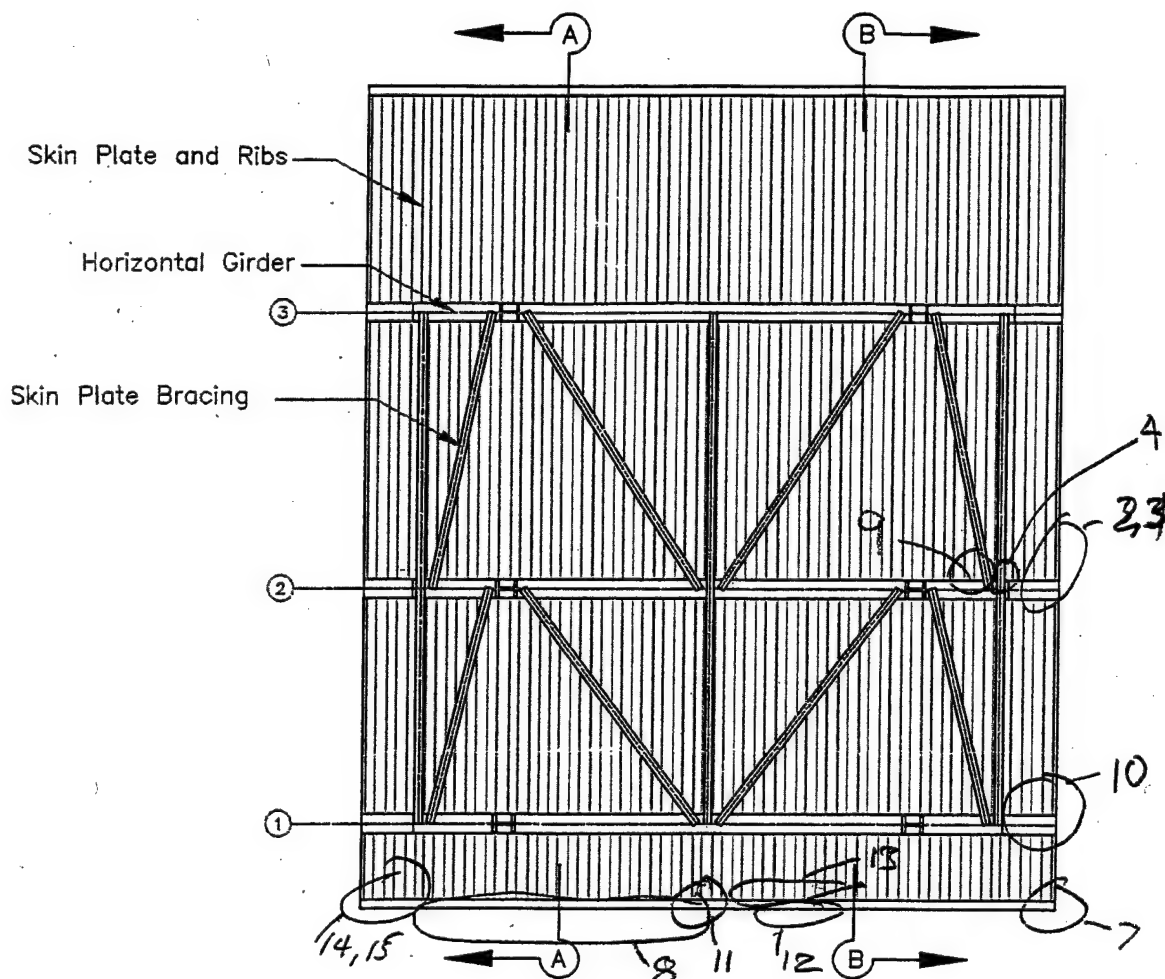
16. LFT Trunnion

Gate No. 2  
Right Elevation A-A



Member	Type	Depth d		Web t <sub>w</sub>		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	b <sub>f</sub>		t <sub>f</sub>	
Strut 3	14 WF 202	15 5/8	15 3/4	15/16		15 3/4	15 3/4	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16		16 3/8	16 3/8	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16		16 5/8	16 5/8	2 13/16	2 3/8
Brace A	14 WF 30	13 7/8	14	5/16		6 3/4	6 13/16	3/8	3/8
Brace B	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 13/16	3/8	
Brace C	14 WF 30	13 7/8	14	5/16		6 3/4	6 13/16	3/8	
Brace D	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	
Brace E	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	
Brace F	14 WF 30	13 7/8	14	5/16		6 3/4	6 13/16	3/8	
Brace G	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 13/16	3/8	
Brace H	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace J	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	7/16
Brace K	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	7/16
Brace L	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 5/16	3/8	3/8
Brace N	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	3/8

Gate No. 2 Downstream Elevation



14, 15 Mock in Bot. Girder

Member	Type	Depth		Web		Flange - End			
		Plan	Measured	Plan	Measured	b <sub>t</sub>		t <sub>t</sub>	
		(in)	(in)	(in)	(in)	Plan	Measured	Plan	Measured
Horiz. Girder 3	PL Girder	49 3/4	49 3/4	7/16	1/2	16	16	7/8	7/8
Horiz. Girder 2	PL Girder	60 1/2	60 5/8	3/4		16 1/2	16 1/2	1 1/4	1 1/4
Horiz. Girder 1	PL Girder	60 1/2	60 1/2	1		16 1/2	16 1/2	1 1/4	1 1/4
Purlins	ST 10 WF 31	10 1/2	10 9/16	13/32		8 1/4	8 1/4	5/8	5/8
Skin PL Bracing	ST 7 WF 15	7	7	1/4	5/16	6 3/4	6 3/4	3/8	3/8

2, 3 Delam. Coating (Paint?)

4. Sway in Vert bracing  $\approx 1/4"$ . The weld is Bent @ Splice

5. Same as 4  $\approx 1"$

7, 8 Bottom Seal Leaks

9. Bot. Girder moderate to Heavy Rust on Fltgs under ant. (Typ Picture)

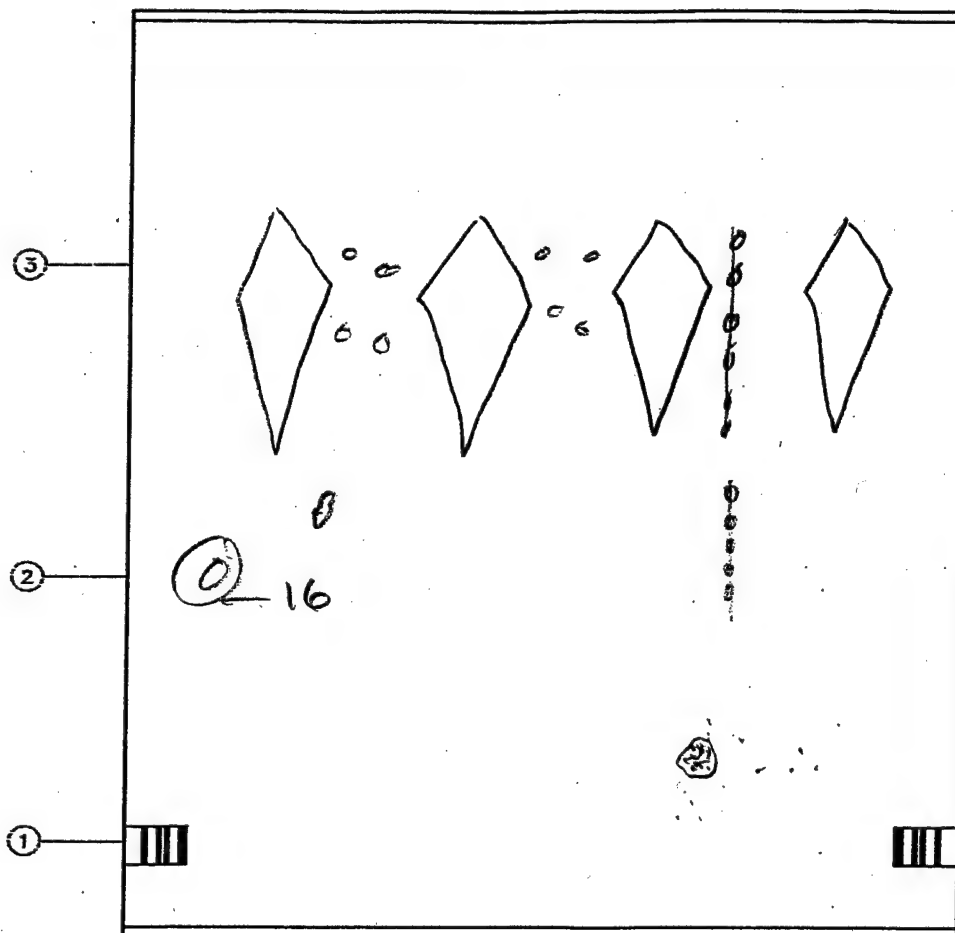
this is also seal on LFT Bot. Shot Flag

10. LFT Bot Girder Brace Pts w/ mod and evidence of standing H<sub>2</sub>O

11, 12 Leaks @ Bot. Seal

13 Standing H<sub>2</sub>O @ Bot. Plate

Gate No. 2 Upstream Elevation \_\_\_\_\_



- Paint Flaking off Due to Pressure Wash ( $\frac{1}{4}$  in)

16: Typ Potting hole  $\approx \frac{1}{8}$ " to  $\frac{1}{4}$ " depth

17

①0

- MORE COR? PITTING IN.  $\frac{1}{2}$ " R THAN OTHER GATES (TVA)

②0 Corroded Weld on left of gate  $\frac{1}{4}$ " deep.  
21, 22

Gate No. 2 Operation and Trunnion Measurements

Racking Measurements: Bottom of Gate and Spillway

LEFT	RIGHT
35 3/4	36 1/2

Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

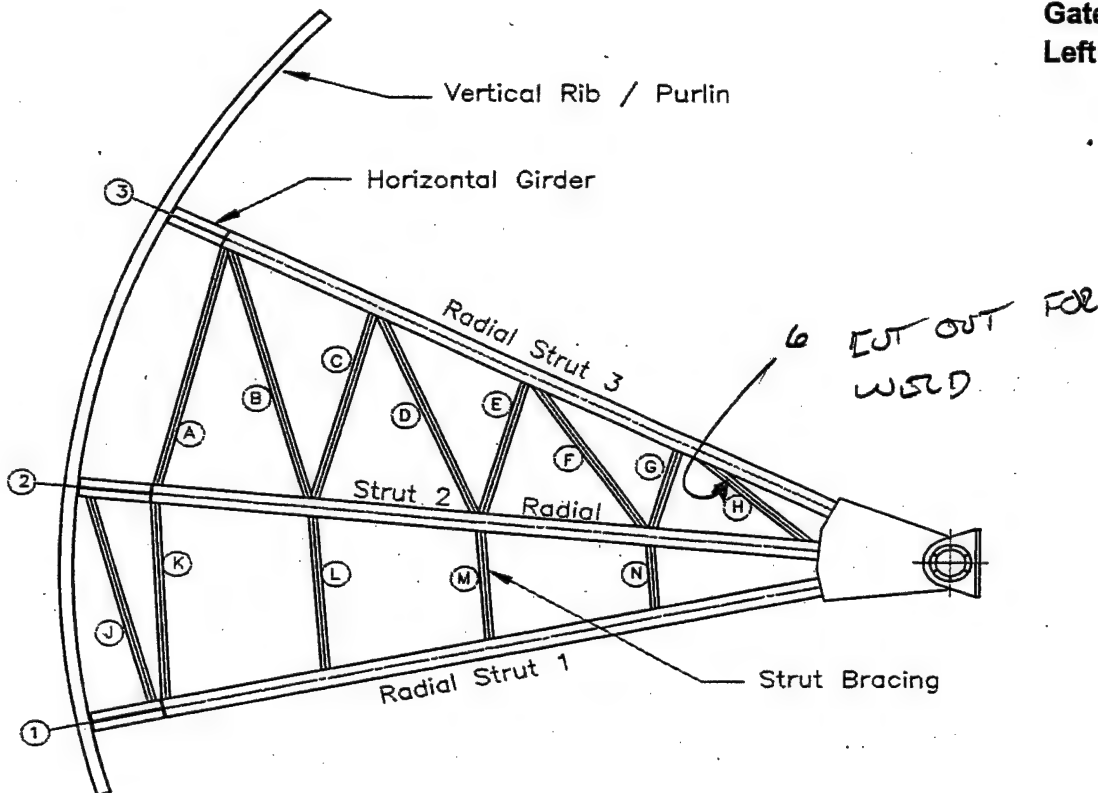
	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	24/32	16/32	21/32	17/32
Gate Full Open	23/32	16/32	22/32	17/32
Final Gate Closed	24/32	16/32	21/32	17/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical					0.0000		-0.0020	
US / DS					0.0000		+0.0390	
Transverse	23/32	16/32	23/32	16/32	21/32	17/32	21/32	17/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside

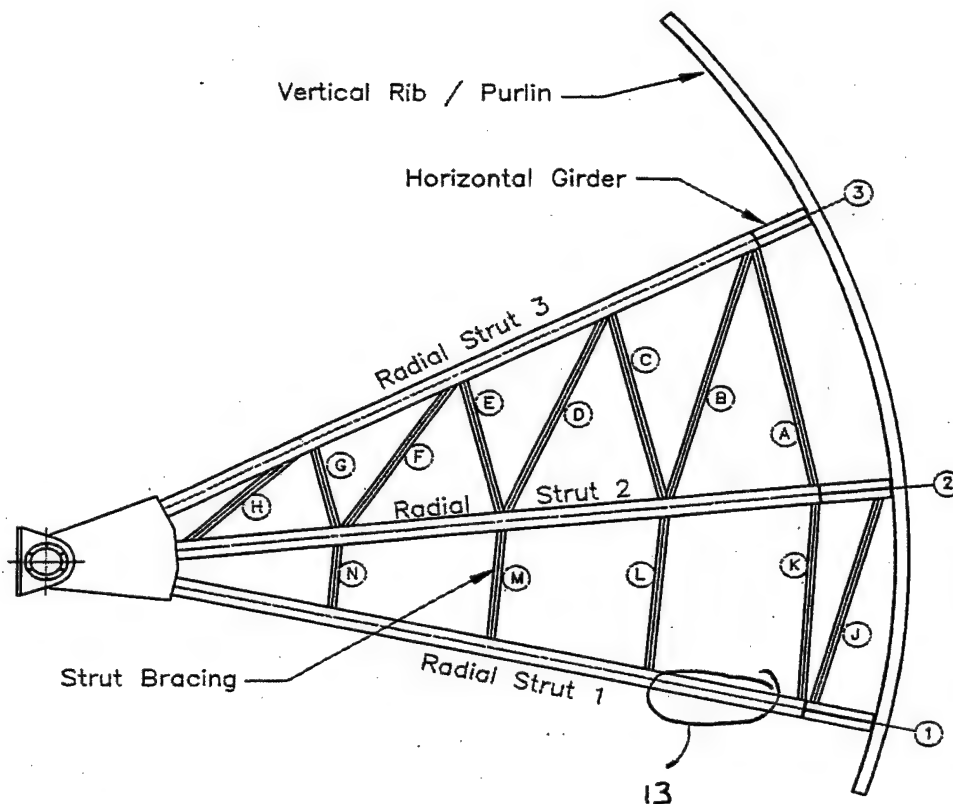
ROCK POCKET / VOID IN SPILLWAY, 10 FT FROM RT PIER

Gate No. 3  
Left Elevation B-B



Member	Type	Depth d		Web t <sub>w</sub>		Flange(s) b <sub>f</sub> t <sub>f</sub>			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 3/4	15/16	—	15 3/4	15 3/4	1 1/2	1 9/16
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16	—	16 3/8	16 3/16	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16	—	16 5/8	16 5/8	2 13/16	2 13/16
Brace A	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace B	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace C	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace D	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace E	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace F	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace G	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace H	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 13/16	3/8	2/8
Brace J	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace K	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace N	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8

Gate No. 3  
Right Elevation A-A

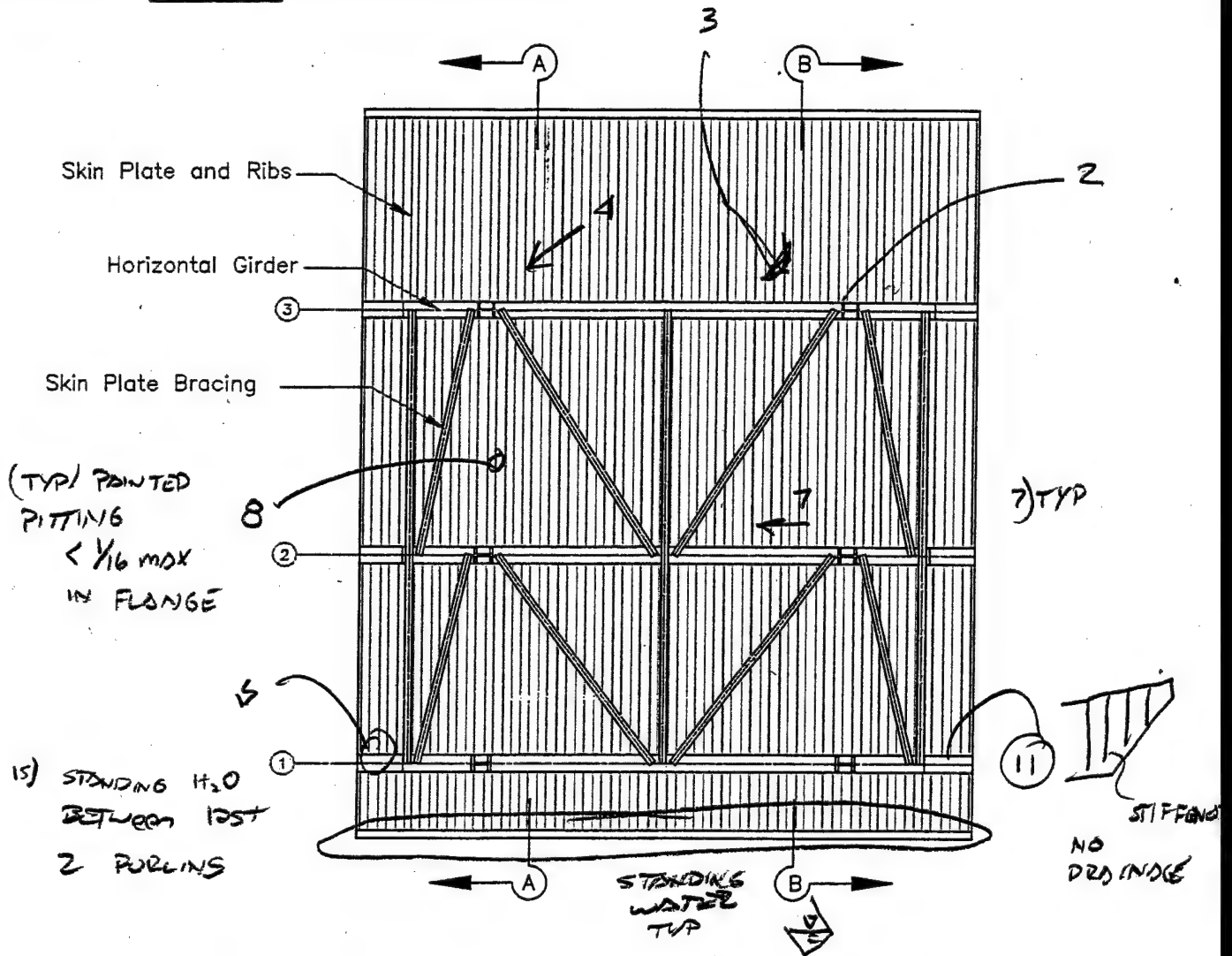


Member	Type	Depth d		Web t <sub>w</sub>		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 11/16	15/16	—	15 3/4	15 3/4	1 1/2	1 9/16
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16	—	16 3/8	16 3/8	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 3/8	1 13/16	—	16 5/8	16 3/8	2 13/16	2 3/16
Brace A	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace B	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace C	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace D	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace E	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace F	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace G	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace H	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace J	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace K	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace N	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8

13) GRIND MARKS



Gate No. 3 Downstream Elevation



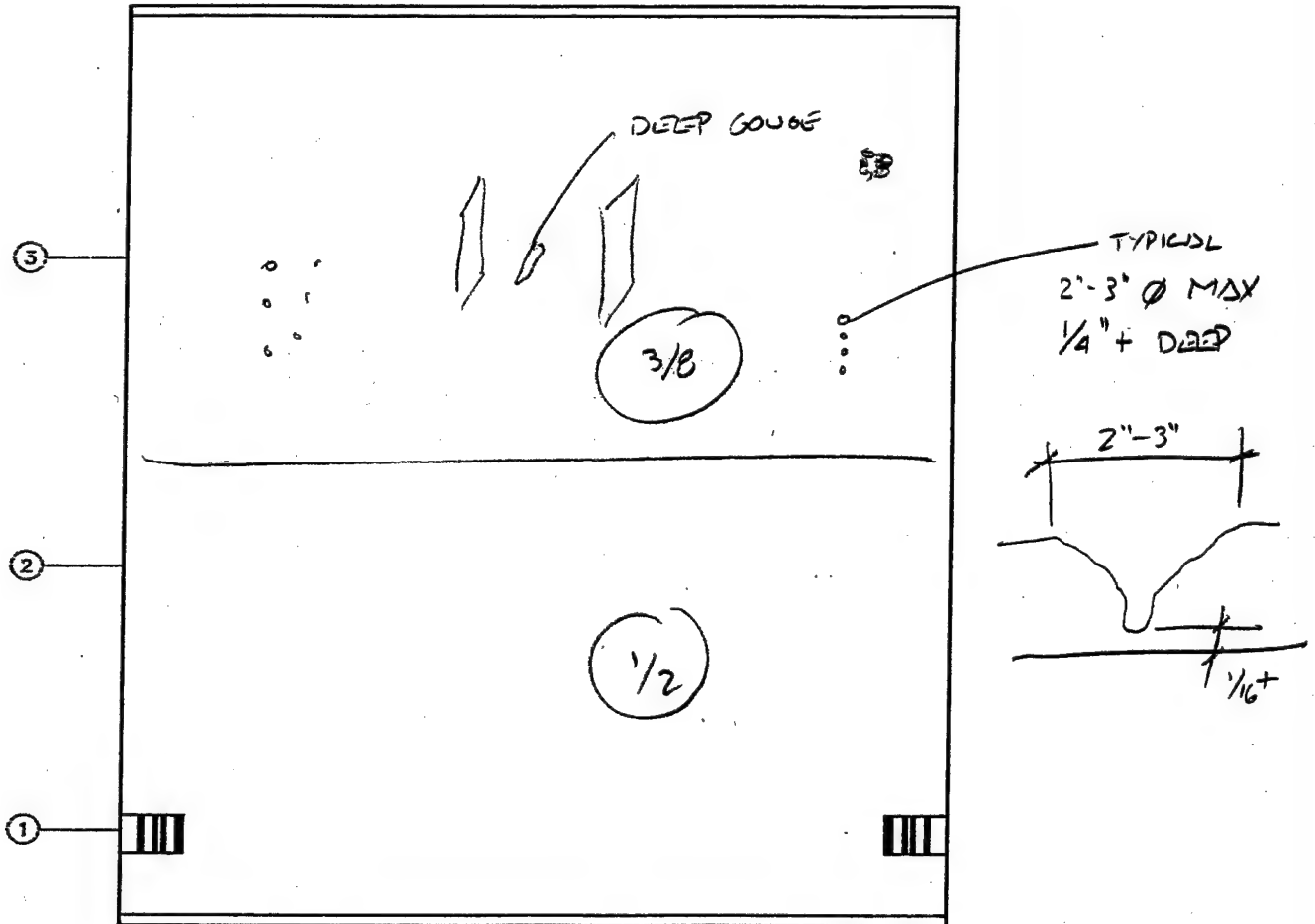
Member	Type	Depth d		Web t <sub>w</sub>		Flange - End			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Horiz. Girder 3	PL Girder	49 3/4	50	7/16	7/16	16	16	7/8	7/8
Horiz. Girder 2	PL Girder	60 1/2	60 1/2	3/4	3/4	16 1/2	16 1/2	1 1/4	1 5/16
Horiz. Girder 1	PL Girder	60 1/2	60 3/4	1	1	16 1/2	16 1/2	1 1/4	1 1/4
Purlins	ST 10 WF 31	10 1/2	10 1/2	13/32	-	8 1/4	8 1/4	5/8	5/8
Skin PL Bracing	ST 7 WF 15	7	7	1/4	1/4	6 3/4	6 3/4	3/8	3/8

2) DELTA LIGHT COR.

3) TYP NOTE: NO WELDS U.S. STIFF

4) NO DIRECT DRAINAGE

Gate No. 3 Upstream Elevation



- HEAVY PITTING

- APPROX 4' GRID AVERAGED

- AVG 2'-3" Ø 1/4" + IN 3/8 R ; 3/8" DEEP IN 1/2" R

Gate No. 3 Operation and Trunnion Measurements

Racking Measurements: Bottom of Gate and Spillway

LEFT	RIGHT
47	47

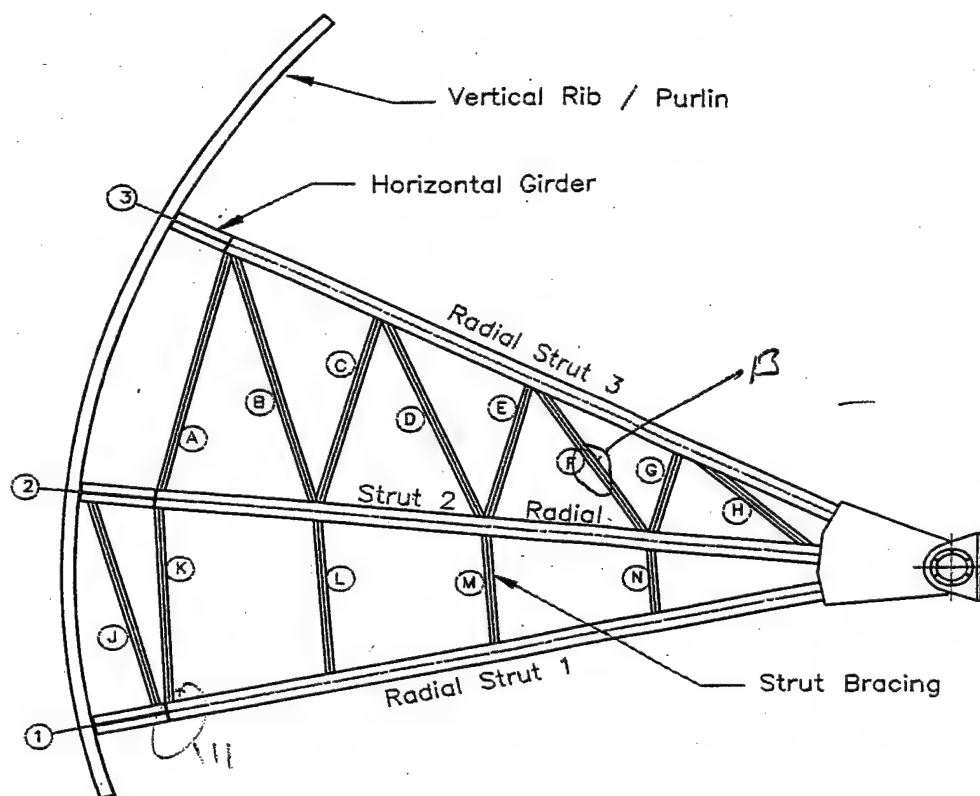
Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	24/32	14/32	24/32	17/32
Gate Full Open	24/32	14/32	24/32	17/32
Final Gate Closed	24/32	14/32	24/32	17/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical	-0.0005		-0.0040					
US / DS	0.0000		+0.0285					
Transverse	24/32	14/32	24/32	14/32	24/32	17/32	24/32	17/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside

Gate No. 4  
~~Left~~ Elevation B-B  
Right

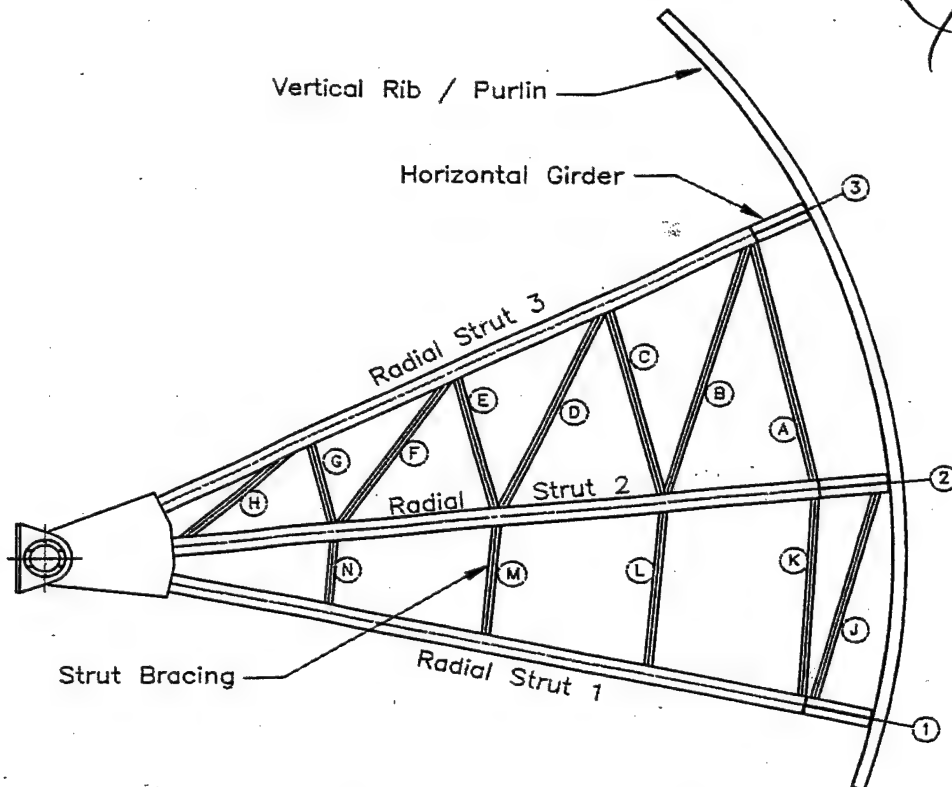


Member	Type	Depth d		Web t <sub>w</sub>		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	b <sub>f</sub>		t <sub>f</sub>	
Strut 3	14 WF 202	15 5/8	15 5/8	15/16		15 3/4	15 3/4	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16		16 3/8	16 1/8	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16		16 5/8	16 3/8	2 13/16	2 7/8
Brace A	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace B	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 1/16	3/8	3/8
Brace C	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace D	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace E	14 WF 30	13 7/8	14	5/16		6 3/4	6 7/8	3/8	3/8
Brace F	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace G	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 15/16	3/8	3/8
Brace H	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace J	14 WF 30	13 7/8	13 7/8	5/16		6 3/4	6 8/14	3/8	3/8
Brace K	14 WF 30	13 7/8	13 7/8	5/16		6 3/4	6 9/14	3/8	3/8
Brace L	14 WF 30	13 7/8	14	5/16		6 3/4	6 7/16	3/8	3/8
Brace M	14 WF 30	13 7/8	14	5/16		6 3/4	6 9/16	3/8	3/8
Brace N	14 WF 30	13 7/8	14	5/16		6 3/4	6 7/16	3/8	3/8

11. Clogged Drain Hole w/ moss growth (standing H<sub>2</sub>O ABOVE)

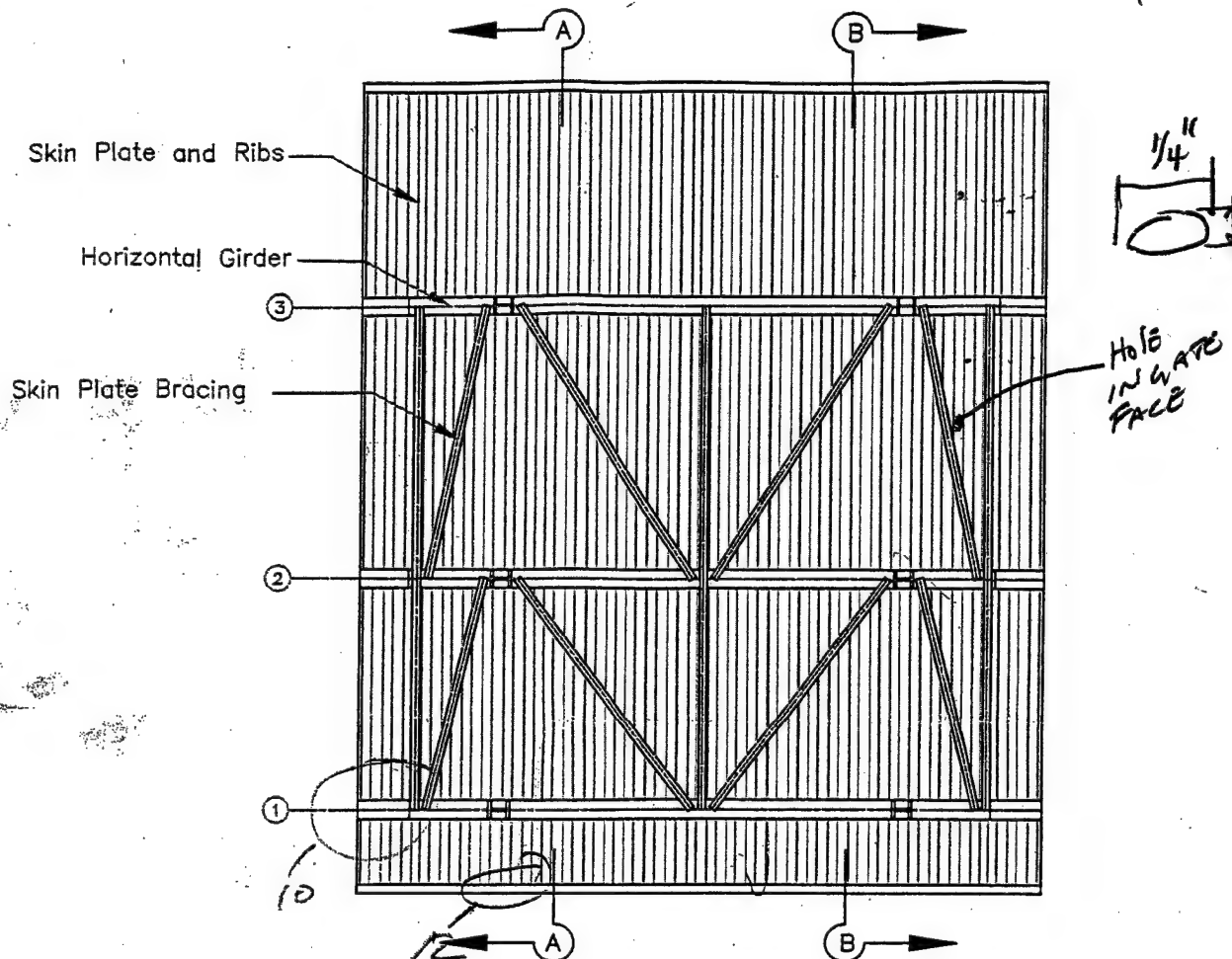
13. Small Deflection in Flange Against Pier ± 1/16" - 1/8"

Gate No. 4  
~~Right Elevation A-A~~  
LEFT



Member	Type	Depth		Web		Flange(s)			
		d		t <sub>w</sub>		b <sub>f</sub>		t <sub>f</sub>	
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 3/8	15/16		15 3/4	15 5/8	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16		16 3/8	16 3/16	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 5/16	1 13/16		16 5/8	16 5/16	2 13/16	2 13/16
Brace A	14 WF 30	13 7/8	13 5/16	5/16		6 3/4	6 3/16	3/8	3/8
Brace B	14 WF 30	13 7/8	13 7/8	5/16		6 3/4	6 7/8	3/8	3/8
Brace C	14 WF 30	13 7/8	13 7/8	5/16		6 3/4	6 3/16	3/8	3/8
Brace D	14 WF 30	13 7/8	13 5/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace E	14 WF 30	13 7/8	14	5/16		6 3/4	6 1/8	3/8	3/8
Brace F	14 WF 30	13 7/8	13 5/16	5/16		6 3/4	6 15/16	3/8	3/8
Brace G	14 WF 30	13 7/8	13 5/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace H	14 WF 30	13 7/8	14 1/4	5/16		6 3/4	6 1/2	3/8	3/8
Brace J	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace K	14 WF 30	13 7/8	14	5/16		6 3/4	6 3/4	3/8	
Brace L	14 WF 30	13 7/8	13 7/8	5/16		6 3/4	6 13/16	3/8	
Brace M	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 13/16	3/8	
Brace N	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 1/2	3/8	

Gate No. 4 Downstream Elevation



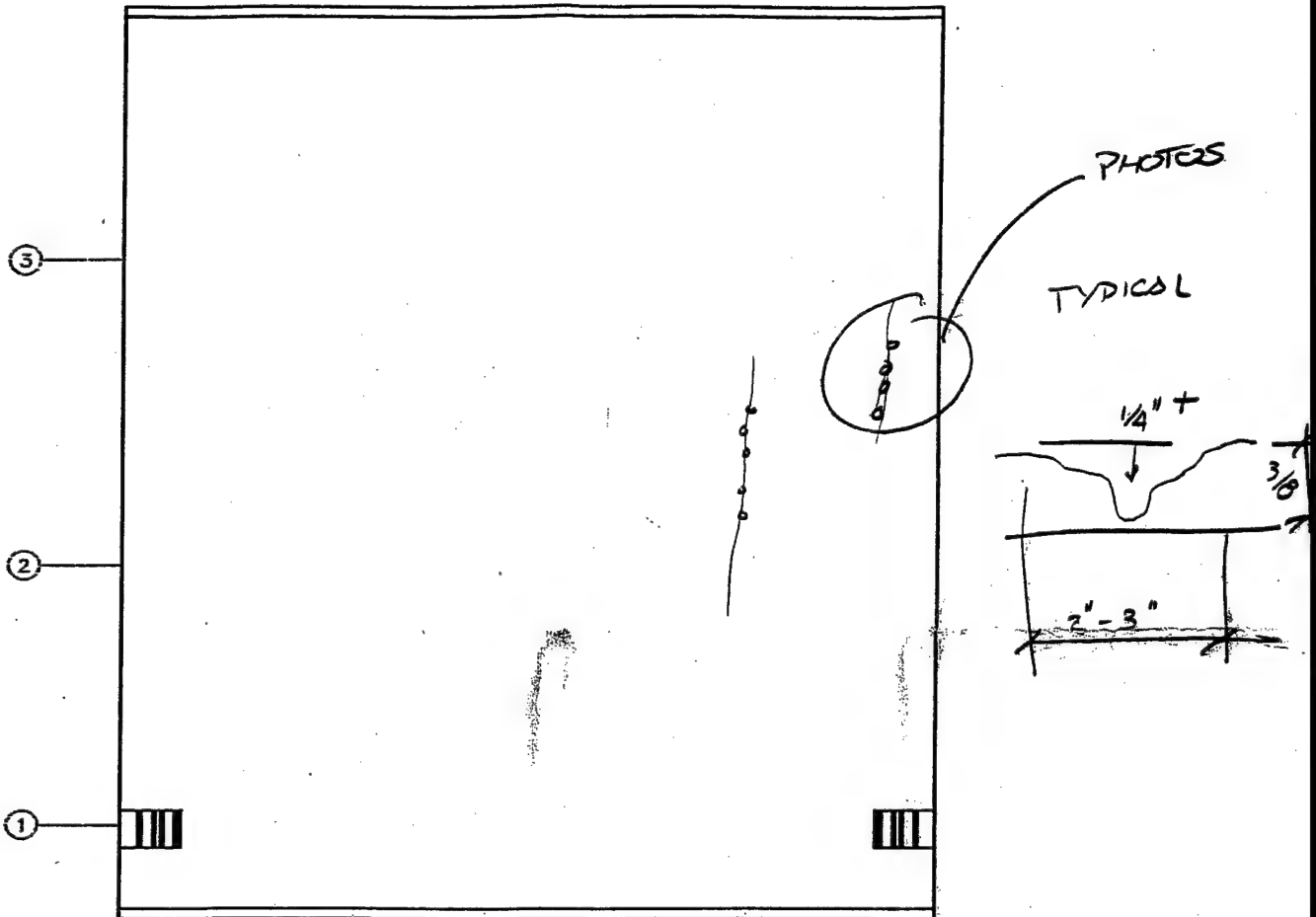
Member	Type	Depth d		Web t <sub>w</sub>		Flange - End			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Horiz. Girder 3	PL Girder	49 3/4	49 5/16	7/16	1/2	16	16	7/8	7/8
Horiz. Girder 2	PL Girder	60 1/2	60 1/2	3/4		16 1/2	16 1/2	1 1/4	1 1/4
Horiz. Girder 1	PL Girder	60 1/2	60 3/8	1		16 1/2	16 1/2	1 1/4	1 1/4
Purlins	ST 10-WF 31	10 1/2	10 3/8	13/32		8 1/4	8 1/4	5/8	5/8
Skin PL Bracing	ST 7-WF 15	7	7	1/4	5/16	6 3/4	6 13/16	3/8	3/8

2-9 Holes in Gate Face.  $\approx 1/4" \times 1/8"$

10. Muck and evidence of standing H<sub>2</sub>O

12. Muck @ Bot. Seal Pit. NO DRAINING H<sub>2</sub>O

Gate No. 4 Upstream Elevation



- HEAVY PITTING  $> 1/4"$  IN  $3/8$  R ISOLATED SPOTS

- APPEARS TO FOLLOW SCRATCHES IN R

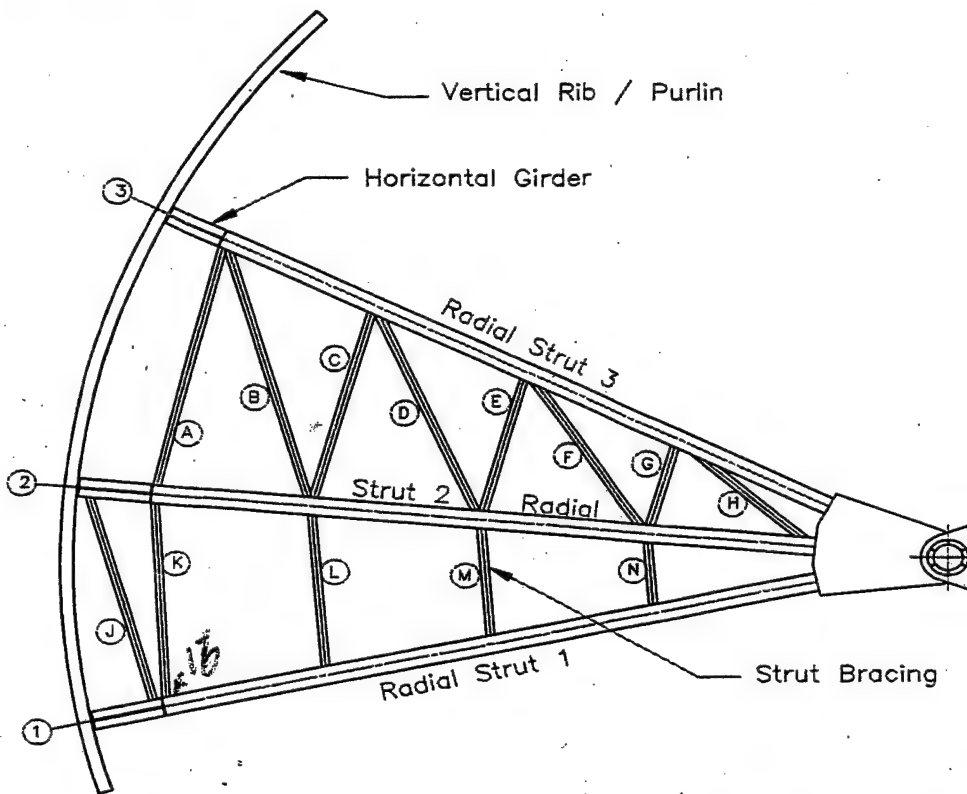
- TYP 2-3'  $\emptyset$

- AVG, PITT ON 4'-5' GRID

	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical	0.0000		-0.0020					
US / DS	-0.0020		+0.0305					
Transverse	21/32	16/32	21/32	16/32	22/32	18/32	22/32	18/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside



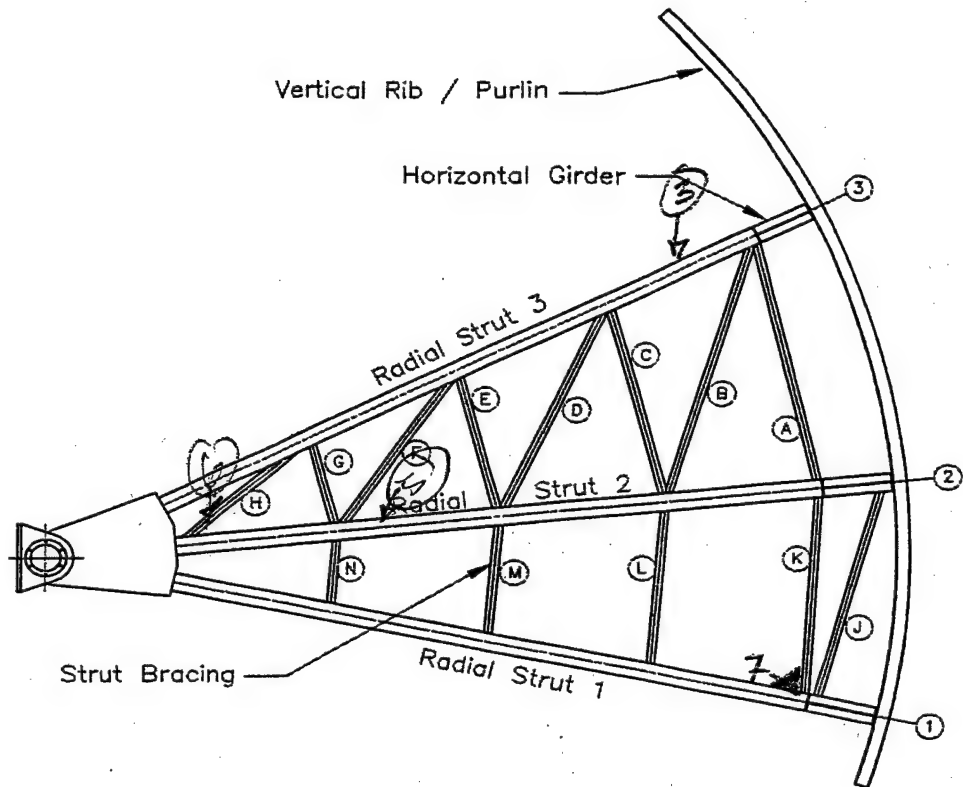
Gate No. 5  
Left Elevation B-B



Member	Type	Depth d		Web t <sub>w</sub>		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 3/8	15/16	—	15 3/4	15 3/8	1 1/2	✓
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16	—	16 3/8	16 3/8	2 7/16	✓
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16	—	16 5/8	16 5/8	2 13/16	✓
Brace A	14 WF 30	13 7/8	14 1/16	5/16	—	6 3/4	6 7/8	3/8	✓
Brace B	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓
Brace C	14 WF 30	13 7/8	14 1/8	5/16	—	6 3/4	6 7/8	3/8	✓
Brace D	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓
Brace E	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓
Brace F	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓
Brace G	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓
Brace H	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓
Brace J	14 WF 30	13 7/8	14 1/16	5/16	—	6 3/4	6 7/8	3/8	✓
Brace K	14 WF 30	13 7/8	14 1/16	5/16	—	6 3/4	6 7/8	3/8	✓
Brace L	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓
Brace M	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 3/4	3/8	✓
Brace N	14 WF 30	13 7/8	14	5/16	—	6 3/4	6 7/8	3/8	✓

(15) Left, bottom member @ cables.  
(16) Rounding @ bottom strut

Gate No. 5  
Right Elevation A-A



Member	Type	Depth d		Web t <sub>w</sub>		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	✓	15/16	✓	15 3/4	15 3/4	1 1/2	✓
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16	✓	16 3/8	16 3/8	2 7/16	✓
Strut 1	14 WF 398	18 1/4	✓	1 13/16	✓	16 5/8	16 5/8	2 13/16	2 5/8
Brace A	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace B	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace C	14 WF 30	13 7/8	12 1/2	5/16	✓	6 3/4	12 1/2	3/8	✓
Brace D	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	12 1/2	3/8	✓
Brace E	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	12 1/2	3/8	✓
Brace F	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	12 1/2	3/8	✓
Brace G	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace H	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace J	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	12 1/2	3/8	✓
Brace K	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	12 1/2	3/8	✓
Brace L	14 WF 30	13 7/8	12 1/2	5/16	✓	6 3/4	12 1/2	3/8	✓
Brace M	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace N	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓

③ Corrosion on top strut

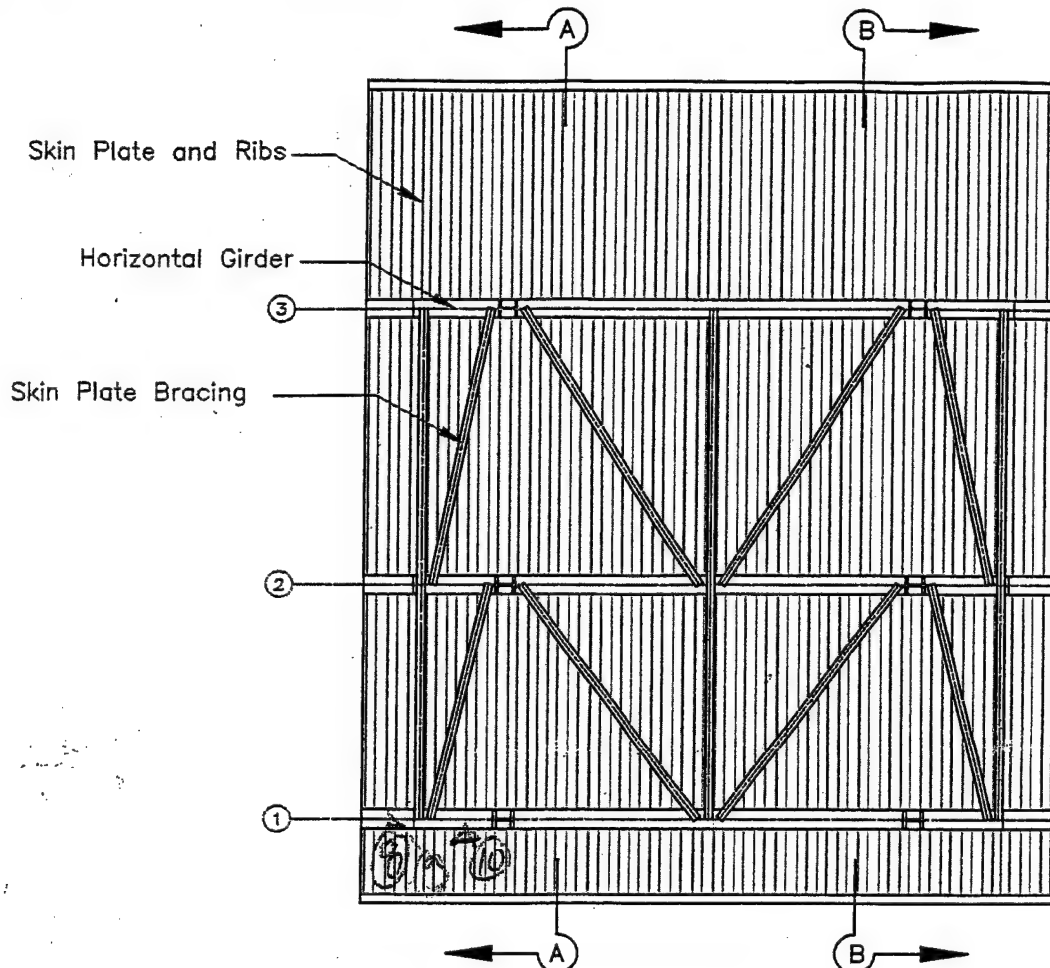
④ Pending water on 2nd girder

⑤ Nick in strut

⑥ Nick in Triangular member

⑦ Pending water @ bottom strut

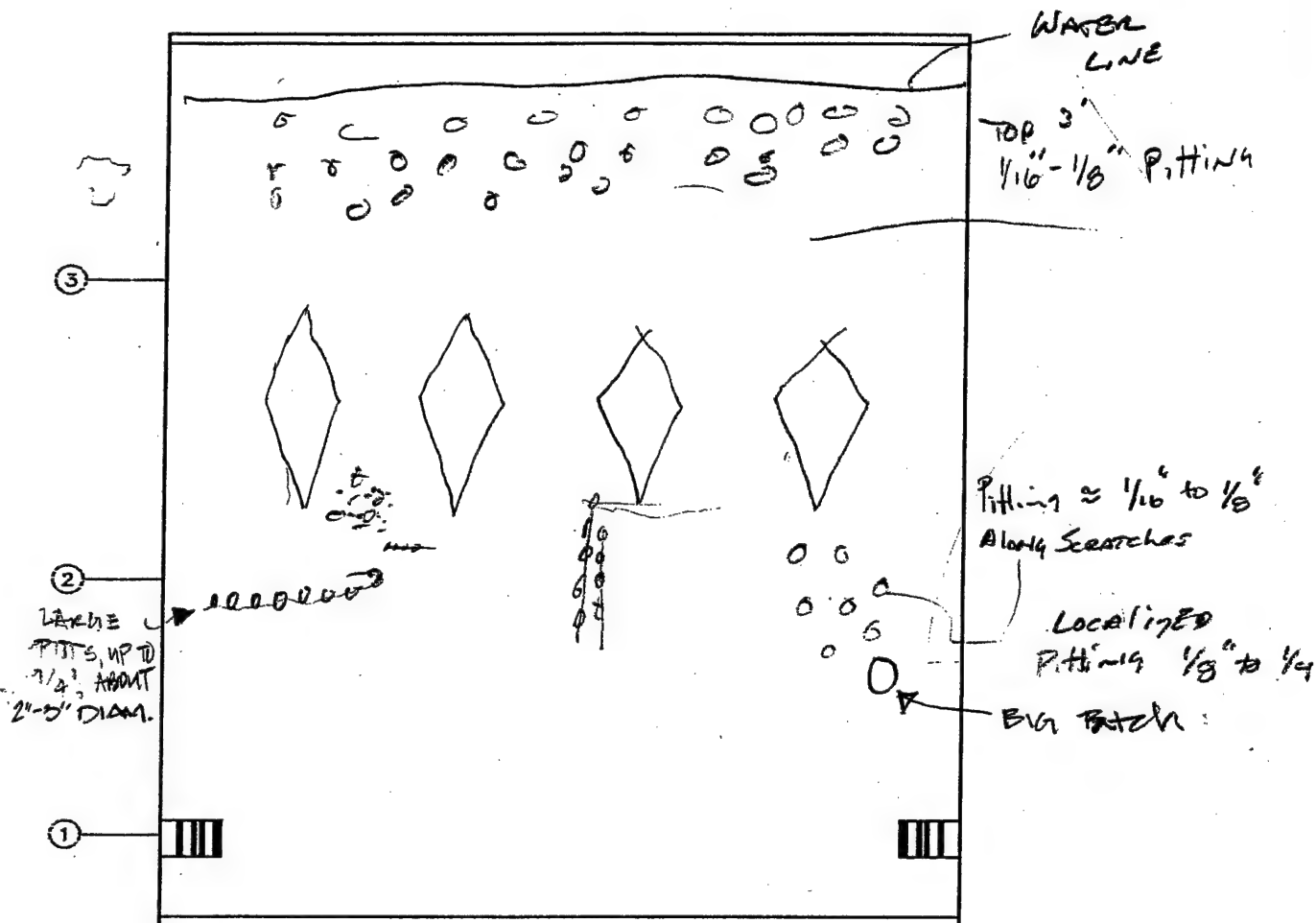
Gate No. 5 Downstream Elevation



Member	Type	Depth		Web		Flange - End			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Horiz. Girder 3	PL Girder	49 3/4	50	7/16	✓	16	✓	7/8	✓
Horiz. Girder 2	PL Girder	60 1/2	✓	3/4	✓	16 1/2	✓	1 1/4	✓
Horiz. Girder 1	PL Girder	60 1/2	✓	1	✓	16 1/2	✓	1 1/4	✓
Purlins	ST 10 WF 31	10 1/2	✓	13/32	✓	8 1/4	✓	5/8	✓
Skin PL Bracing	ST 7 WF 15	7	✓	1/4	✓	6 3/4	✓	3/8	✓

① Leak in side seal, on top girder  
② ponding water @ middle  
③ ponding water overall  
④ ponding water in bottom girder  
⑤ side seal, intact  
⑥ bottom seal ✓ from R→L  
⑦ ⑧ ponding in purlins & bottom gate

Gate No. 5 Upstream Elevation



Gate No. 5 Operation and Trunnion Measurements

Racking Measurements: Bottom of Gate and Spillway

LEFT	RIGHT
24 3/4	24 3/4

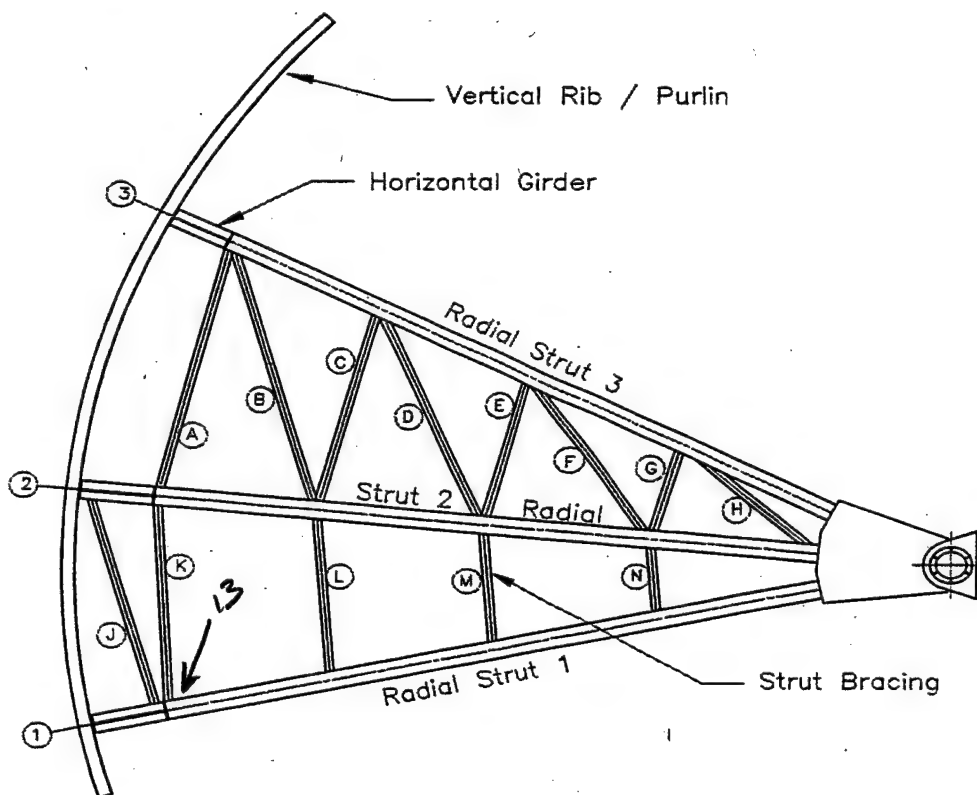
Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	22/32	16/32	24/32	16/32
Gate Full Open	20/32	16/32	24/32	16/32
Final Gate Closed	22/32	16/32	24/32	16/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical	-0.0005		+0.0150					
US / DS	-0.0030		+0.0510					
Transverse	22/32	16/32	22/32	16/32	24/32	16/32	24/32	16/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside

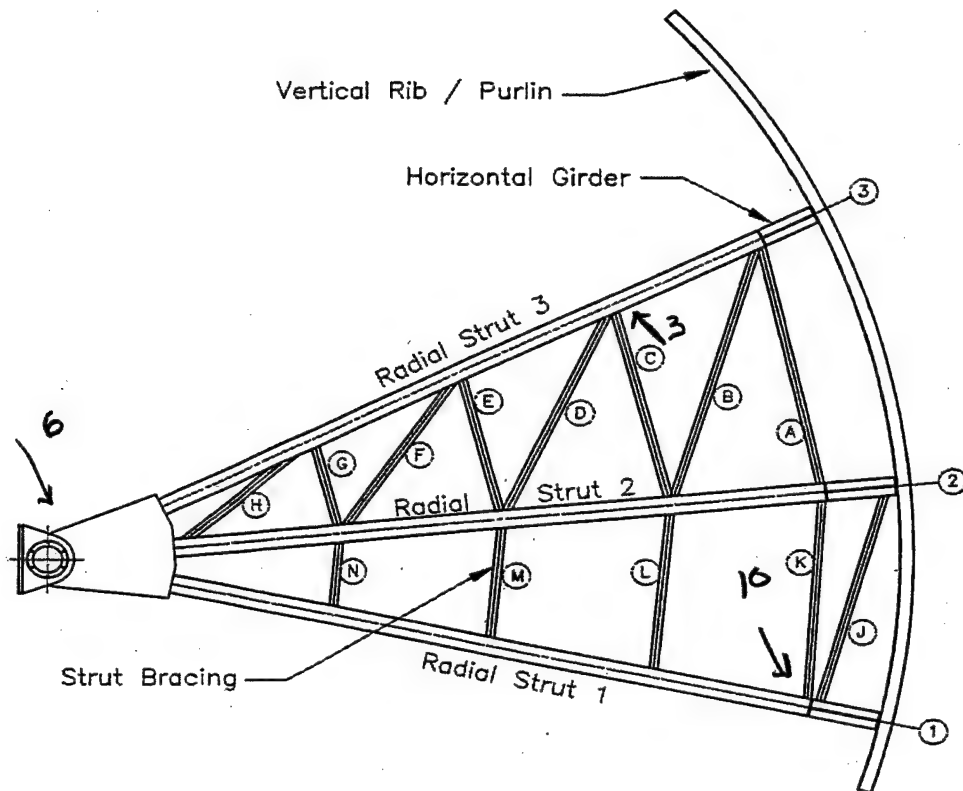
Gate No. 6  
Left Elevation B-B



Member	Type	Depth d		Web t <sub>w</sub>		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 5/8	15/16	—	15 3/4	15 3/4	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 5/8	1 9/16	—	16 3/8	16 3/8	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 5/16	1 13/16	—	16 5/8	16 3/8	2 13/16	2 7/8
Brace A	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace B	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace C	14 WF 30	13 7/8	13 15/16	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace D	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace E	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace F	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace G	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace H	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace J	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace K	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8
Brace N	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 3/4	3/8	3/8

13) LIGHT CO2, PAST STANDING WATER

Gate No. 6  
Right Elevation A-A

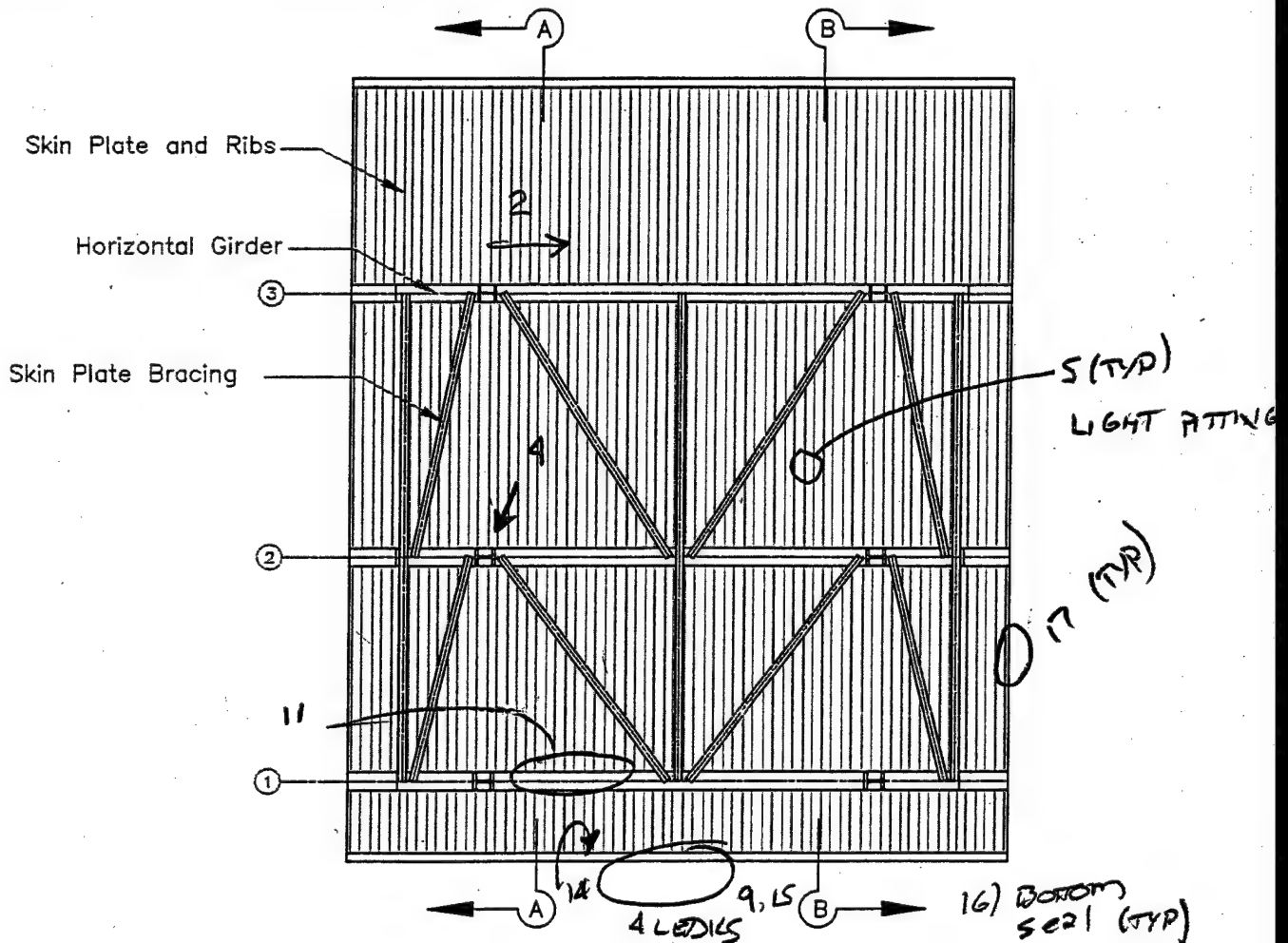


Member	Type	Depth d		Web t <sub>w</sub>		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 5/8	15/16	—	15 3/4	15 3/4	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 3/8	1 9/16	—	16 3/8	16 1/8	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16	—	16 5/8	16 3/8	2 13/16	2 13/16
Brace A	14 WF 30	13 7/8	14 7/16	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace B	14 WF 30	13 7/8	14 1/16	5/16	5/16	6 3/4	7	3/8	3/8
Brace C	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 15/16	3/8	3/8
Brace D	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	7	3/8	3/8
Brace E	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	7	3/8	3/8
Brace F	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace G	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace H	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	7	3/8	3/8
Brace J	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace K	14 WF 30	13 7/8	13 5/16	5/16	5/16	6 3/4	7	3/8	3/8
Brace L	14 WF 30	13 7/8	14	5/16	5/16	6 3/4	6 7/8	3/8	3/8
Brace M	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	6 15/16	3/8	3/8
Brace N	14 WF 30	13 7/8	13 7/8	5/16	5/16	6 3/4	7	3/8	3/8

10) STANDING WATER, CLOGGED DRAIN



Gate No. 6 Downstream Elevation



Member	Type	Depth d		Web t <sub>w</sub>		Flange - End			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Horiz. Girder 3	PL Girder	49 3/4	50 1/16	7/16	15/32	16	16	7/8	7/8
Horiz. Girder 2	PL Girder	60 1/2	60 9/16	3/4	3/4	16 1/2	16 1/2	1 1/4	1 5/16
Horiz. Girder 1	PL Girder	60 1/2	60 1/2	1	1	16 1/2	16 1/2	1 1/4	1 5/16
Purlins	ST 10 WF 31	10 1/2	10 7/16	13/32	→	8 1/4	8 1/4	5/8	5/8
Skin PL Bracing	ST 7 WF 15	7	7	1/4	1/4	6 3/4	6 2/8	3/8	3/8

2) TOP HORIZ (TYP) EVID. POST STANDING WATER

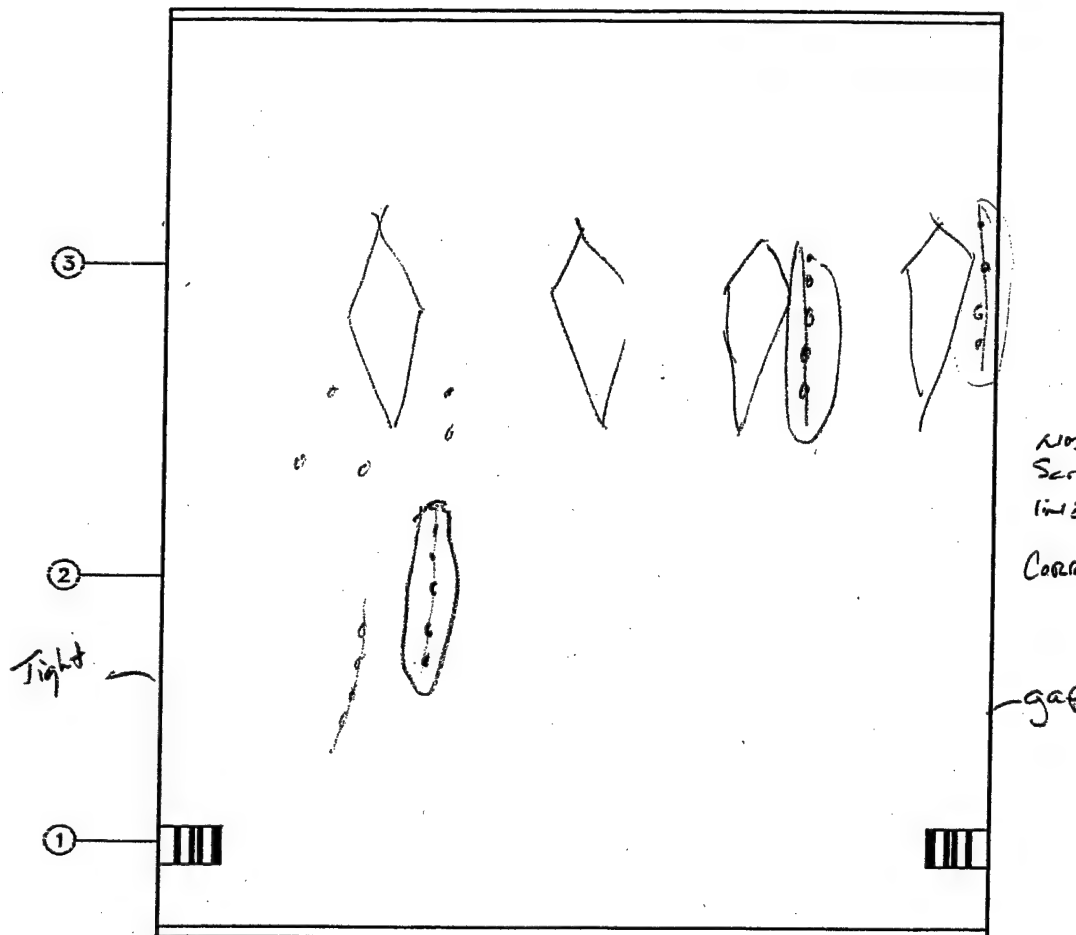
4) DS FLANGE, LIGHT COR, EVID STANDING WATER

11) EVIDENCE CLOGGED DRAIN/ STANDING WATER

14) STANDING WATER (TYP)



Gate No. 6 Upstream Elevation



① Gate PIC. 1D.

② Ponding @ Bottom of Gate

③ Bottom Seal

④ Bottom Seal Gate L → R

⑤ West up of ponding.

- the gate is tight on LEFT SIDE w/o a gap on RIGHT SIDE.

Gate No. 6 Operation and Trunnion Measurements

Racking Measurements: Bottom of Gate and Spillway

LEFT
30 1/4

RIGHT
30 1/4

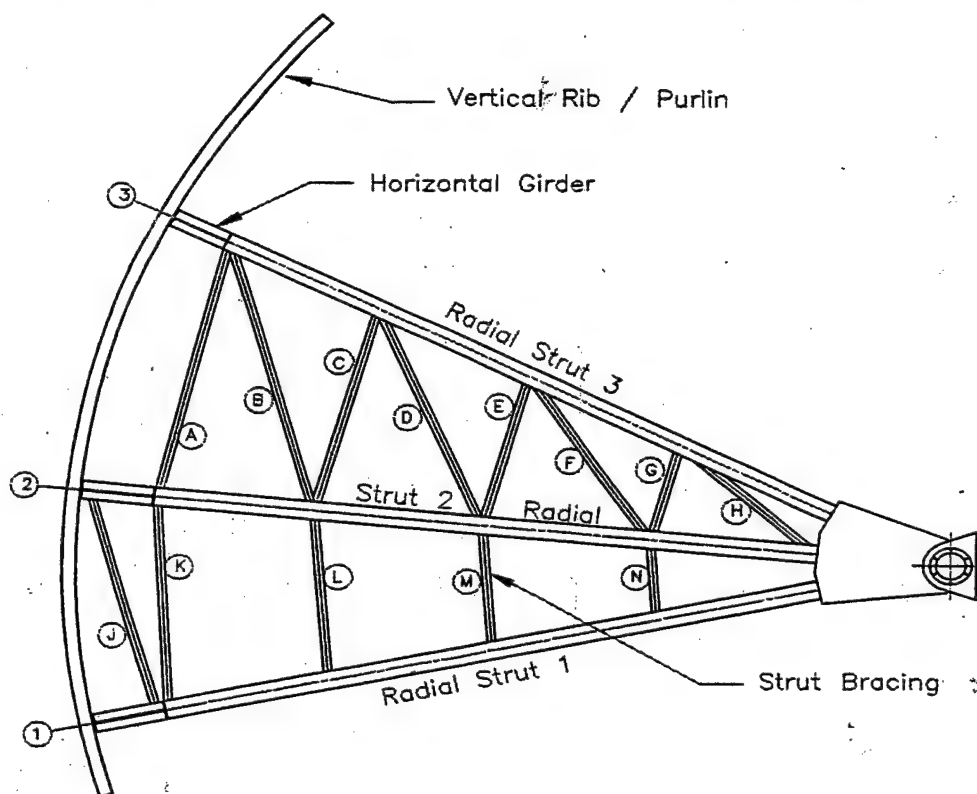
Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	30/32	16/32	21/32	23/32
Gate Full Open	30/32	16/32	20/32	23/32
Final Gate Closed	30/32	16/32	21/32	23/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

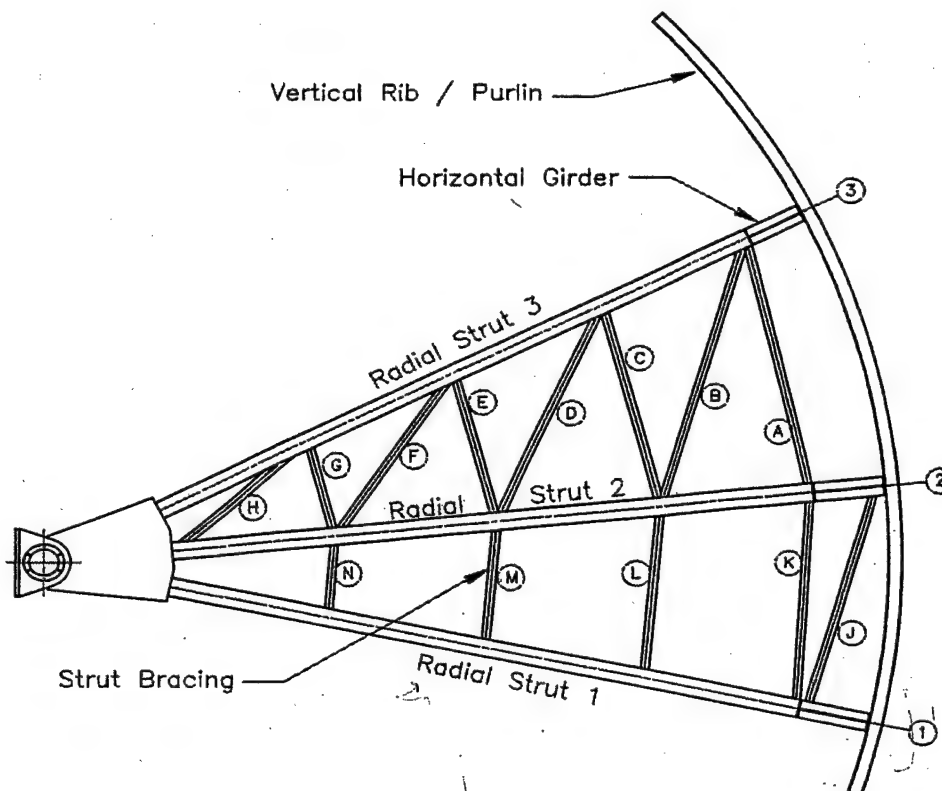
	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical	-0.0005		-0.0095					
US / DS	-0.0005		+0.0350					
Transverse	30/32	16/32	30/32	16/32	21/32	23/32	21/32	23/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside

Gate No. 7  
Left Elevation B-B



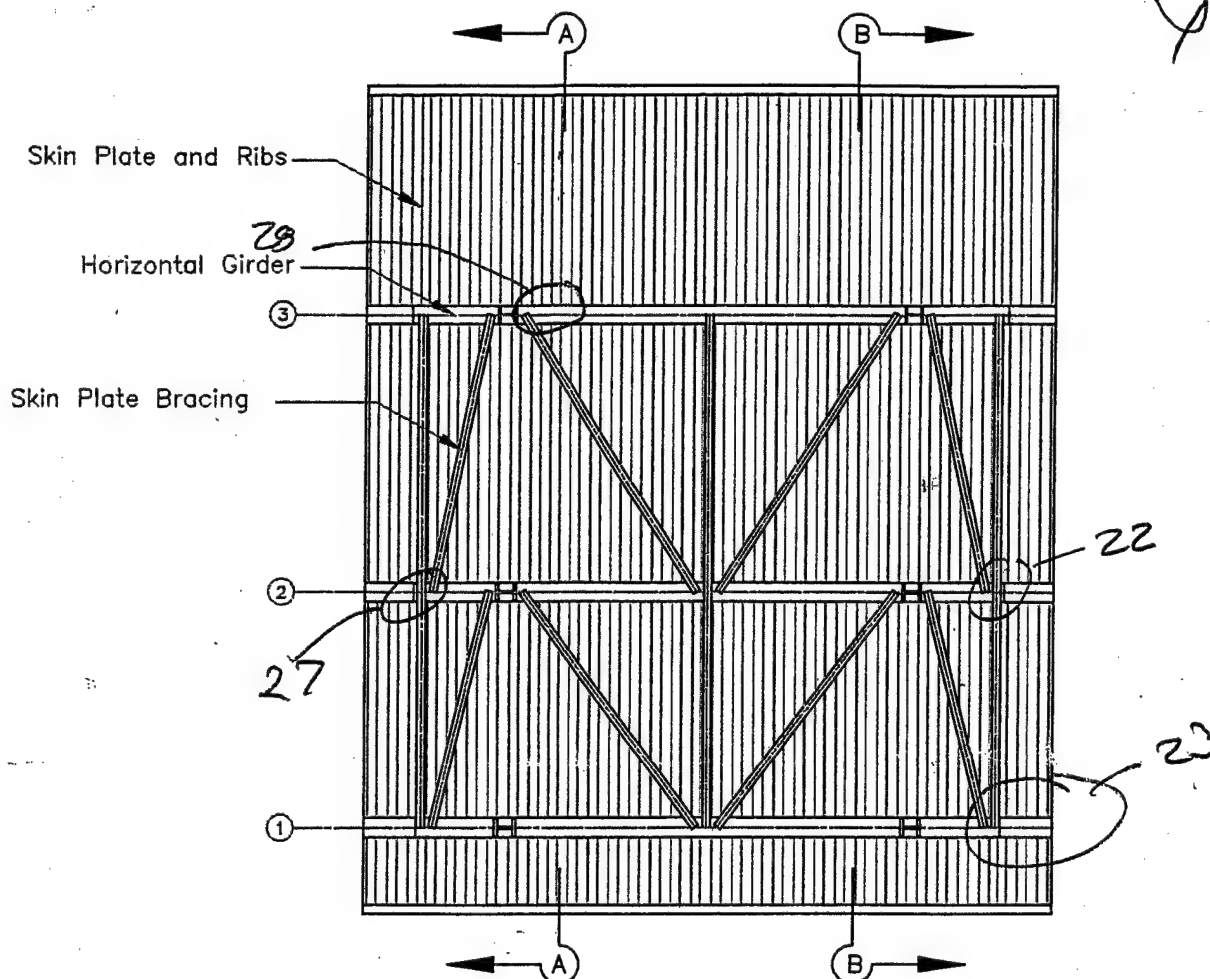
Member	Type	Depth d		Web t <sub>w</sub>		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 5/8	15/16		15 3/4	15 5/8	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 1/16	1 9/16		16 3/8	16 3/16	2 7/16	2 7/16
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16		16 5/8	16 3/16	2 13/16	2 7/8
Brace A	14 WF 30	13 7/8	14	5/16		6 3/4	6 7/8	3/8	3/8
Brace B	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace C	14 WF 30	13 7/8	14	5/16		6 3/4	6 3/4	3/8	3/8
Brace D	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 12/16	3/8	3/8
Brace E	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace F	14 WF 30	13 7/8	13 5/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace G	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace H	14 WF 30	13 7/8	14	5/16		6 3/4	6 3/4	3/8	3/4
Brace J	14 WF 30	13 7/8	14 1/16	5/16		6 3/4	6 3/4	3/8	7/16
Brace K	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	13 15/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace N	14 WF 30	13 7/8	14	5/16		6 3/4	6 3/4	3/8	3/8

Gate No. 7  
Right Elevation A-A



Member	Type	Depth d		Web t <sub>w</sub>		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	15 5/8	15/16		15 3/4	15 1/8	1 1/2	1 1/2
Strut 2	14 WF 342	17 1/2	17 1/2	1 9/16		16 3/8	16 1/16	2 7/16	2 1/2
Strut 1	14 WF 398	18 1/4	18 1/4	1 13/16		16 5/8	16 3/16	2 13/16	2 1/16
Brace A	14 WF 30	13 7/8	13 5/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace B	14 WF 30	13 7/8	13 5/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace C	14 WF 30	13 7/8	13 5/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace D	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace E	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 7/8	3/8	3/8
Brace F	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace G	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 5/8	3/8	3/8
Brace H	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 13/16	3/8	3/8
Brace J	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace K	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace L	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace M	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 3/4	3/8	3/8
Brace N	14 WF 30	13 7/8	13 1/16	5/16		6 3/4	6 3/4	3/8	3/8

Gate No. 7 Downstream Elevation



Member	Type	Depth		Web		Flange - End			
		Plan	Measured	Plan	Measured	Plan	Measured	Plan	Measured
Horiz. Girder 3	PL Girder	49 3/4	49 13/16	7/16	7 1/16	16	16	7/8	7/8
Horiz. Girder 2	PL Girder	60 1/2	60 1/2	3/4	3 1/4	16 1/2	16 1/2	1 1/4	1 1/4
Horiz. Girder 1	PL Girder	60 1/2	60 1/4	1		16 1/2	16 1/2	1 1/4	1 1/4
Purlins	ST 10 WF 31	10 1/2	10 1/2	13/32		8 1/4	8 1/4	5/8	5/8
Skin PL Bracing	ST 7 WF 15	7	7	1/4	1/4	6 3/4	6 3/4	3/8	3/8

22. Brace plates @ 2nd strut to girder. NOT WELDED @ back of GIRDER (Typ.)

23. Evidence of standing H<sub>2</sub>O w/ Debris

24. Standing H<sub>2</sub>O AND Muck in Bot. SEAL Plt.

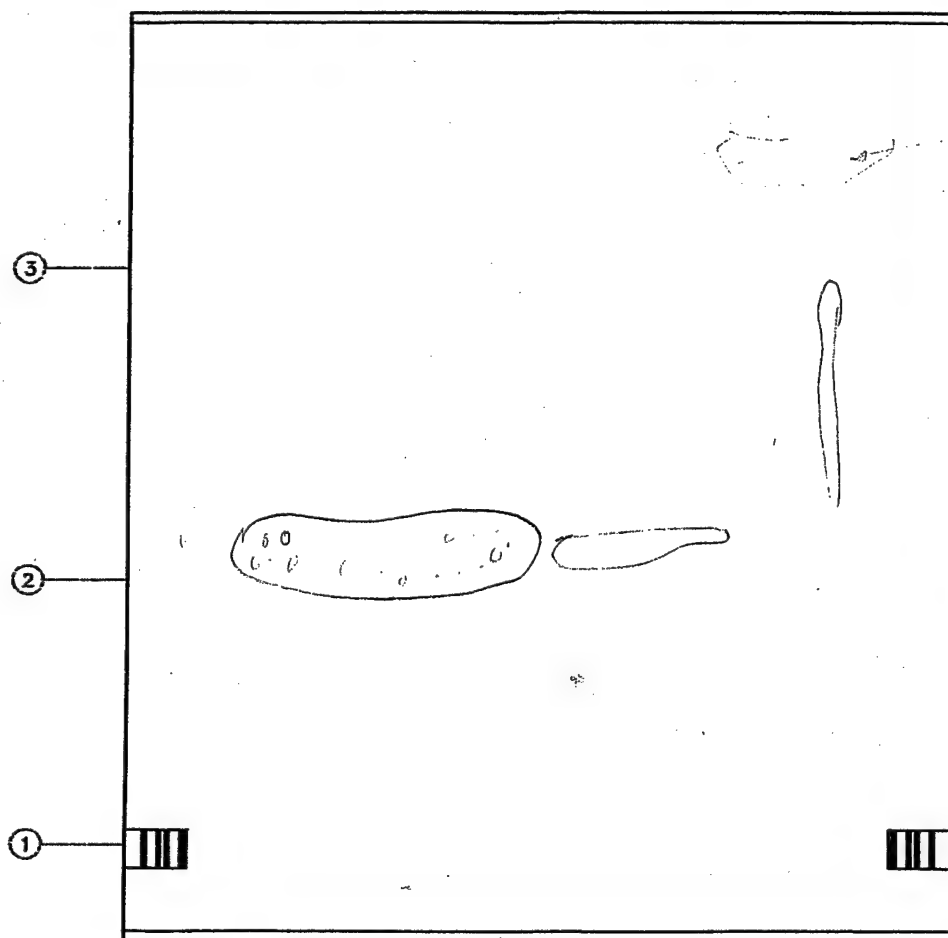
25. LEAKS ALONG Bot. SEAL

26. Bot. LFT. STRUT @ Bot Girder Light Rust

27. BENT WEB OF T Beam

28. Light Rust & Delam. PNT.

Gate No. 7 Upstream Elevation \_\_\_\_\_



- CORROSION PITS ARE IN GROUPS.  $\frac{1}{2}$  -  $\frac{1}{4}$ " DEEP
- Cables on LEFT SIDE: High Vibrations
- BOTTOM 3rd PITS ARE EVERY  $1\frac{1}{2}$  - 2' ON AVE.

Gate No. 7 Operation and Trunnion Measurements

Racking Measurements: Bottom of Gate and Spillway

LEFT	RIGHT
24 3/4	24 3/4

Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

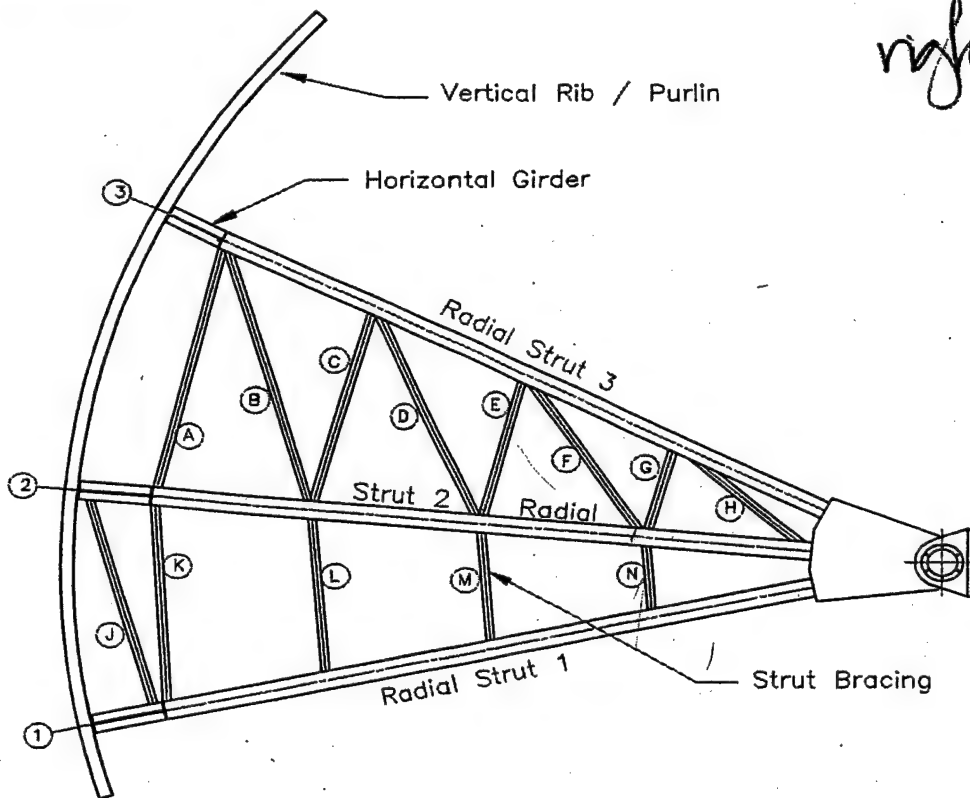
	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	28/32	20/32	22/32	17/32
Gate Full Open	28/32	20/32	22/32	17/32
Final Gate Closed	28/32	20/32	22/32	17/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical	+0.0023		+0.0075					
US / DS	-0.0005		+0.0340					
Transverse	28/32	20/32	28/32	20/32	22/32	17/32	22/32	17/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside

HEAVY VIBRATION & HAMMER  $\approx$  18'-19' OPEN

BOTTOM GIRDER, RIGHT SIDE APPEARS TO BE  
DRAGGING ON PIER



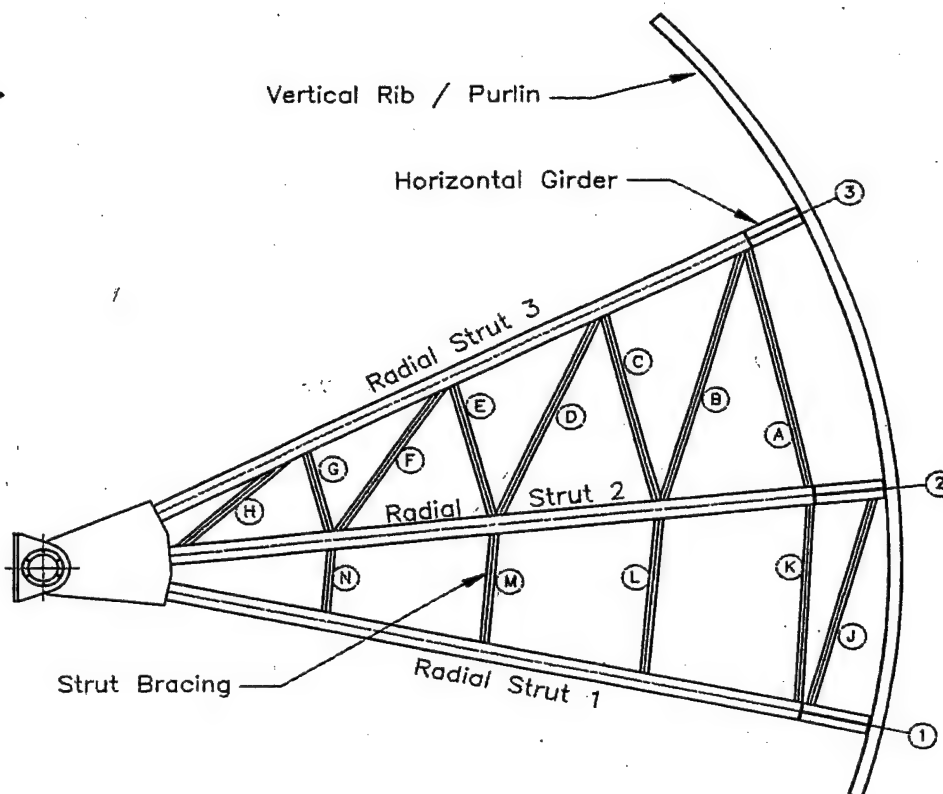
right. Gate No. 8  
Left Elevation B-B  
A-A.

Member	Type	Depth d		Web t <sub>w</sub>		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	✓	15/16	—	15 3/4	✓	1 1/2	✓
Strut 2	14 WF 342	17 1/2	✓	1 9/16	—	16 3/8	✓	2 7/16	✓
Strut 1	14 WF 398	18 1/4	✓	1 13/16	—	16 5/8	✓	2 13/16	✓
Brace A	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace B	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace C	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace D	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace E	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace F	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace G	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace H	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace J	14 WF 30	13 7/8	14 1/2	5/16	—	6 3/4	6 5/8	3/8	✓
Brace K	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace L	14 WF 30	13 7/8	✓	5/16	—	6 3/4	6 1/2	3/8	✓
Brace M	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓
Brace N	14 WF 30	13 7/8	14	5/16	—	6 3/4	✓	3/8	✓

① cable slots, left, dry



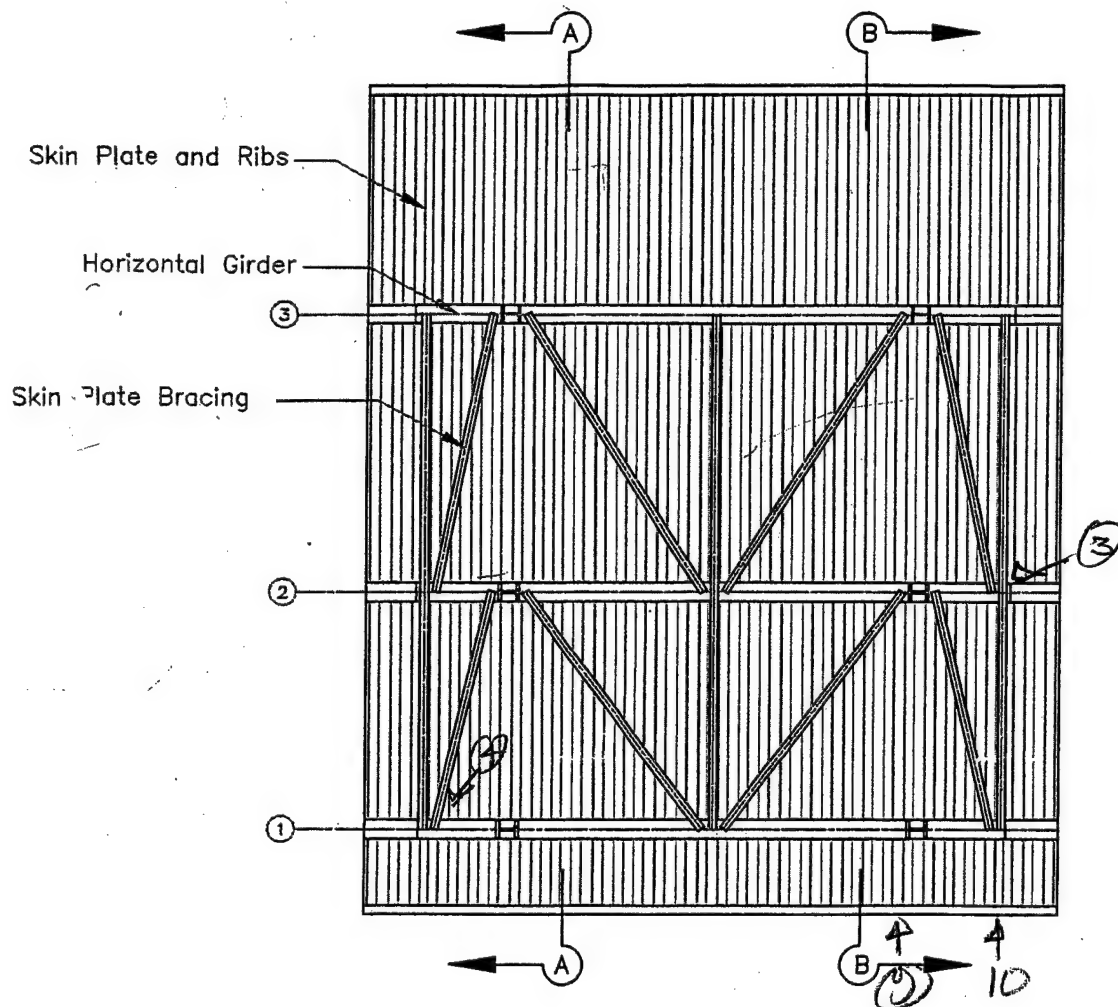
Gate No. 8  
~~Right Elevation AA~~  
Left BB



Member	Type	Depth d		Web t <sub>w</sub>		Flange(s)			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Strut 3	14 WF 202	15 5/8	✓	15/16	✓	15 3/4	✓	1 1/2	✓
Strut 2	14 WF 342	17 1/2	✓	1 9/16	✓	16 3/8	✓	2 7/16	✓
Strut 1	14 WF 398	18 1/4	✓	1 13/16	✓	16 5/8	✓	2 13/16	✓
Brace A	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace B	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace C	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace D	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace E	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace F	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace G	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace H	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace J	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace K	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace L	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace M	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓
Brace N	14 WF 30	13 7/8	✓	5/16	✓	6 3/4	✓	3/8	✓

- (15) Left side seal, ponding water, leak, bottom.
- (16) Purlin on second girder, pitting, top
- (17) Gate face on second girder, pitting, top
- (18) Left. trunnion, top strut, corrosion, before
- (19) after, light corrosion
- (20) Overall gate face

Gate No. 3 Downstream Elevation



Member	Type	Depth		Web		Flange - End			
		Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)	Plan (in)	Measured (in)
Horiz. Girder 3	PL Girder	49 3/4	✓	7/16	✓	16	✓	7/8	✓
Horiz. Girder 2	PL Girder	60 1/2	✓	3/4	✓	16 1/2	✓	1 1/4	✓
Horiz. Girder 1	PL Girder	60 1/2	✓	1	✓	16 1/2	✓	1 1/4	✓
Purlins	ST 10 WF 31	10 1/2	✓	13/32	✓	8 1/4	8 1/4	5/8	✓
Skin PL Bracing	ST 7 WF 15	7	✓	1/4	5/16	6 3/4	12 13/16	3/8	✓

③ Ponding in Second girder, no corrosion

④ Leak on left

⑤ Side Seals, right. look good.

⑥ Leaking bottom seal, left side

⑦ Ponding water in bottom strand

⑧ Ponding water, right, bottom girder, cable slots

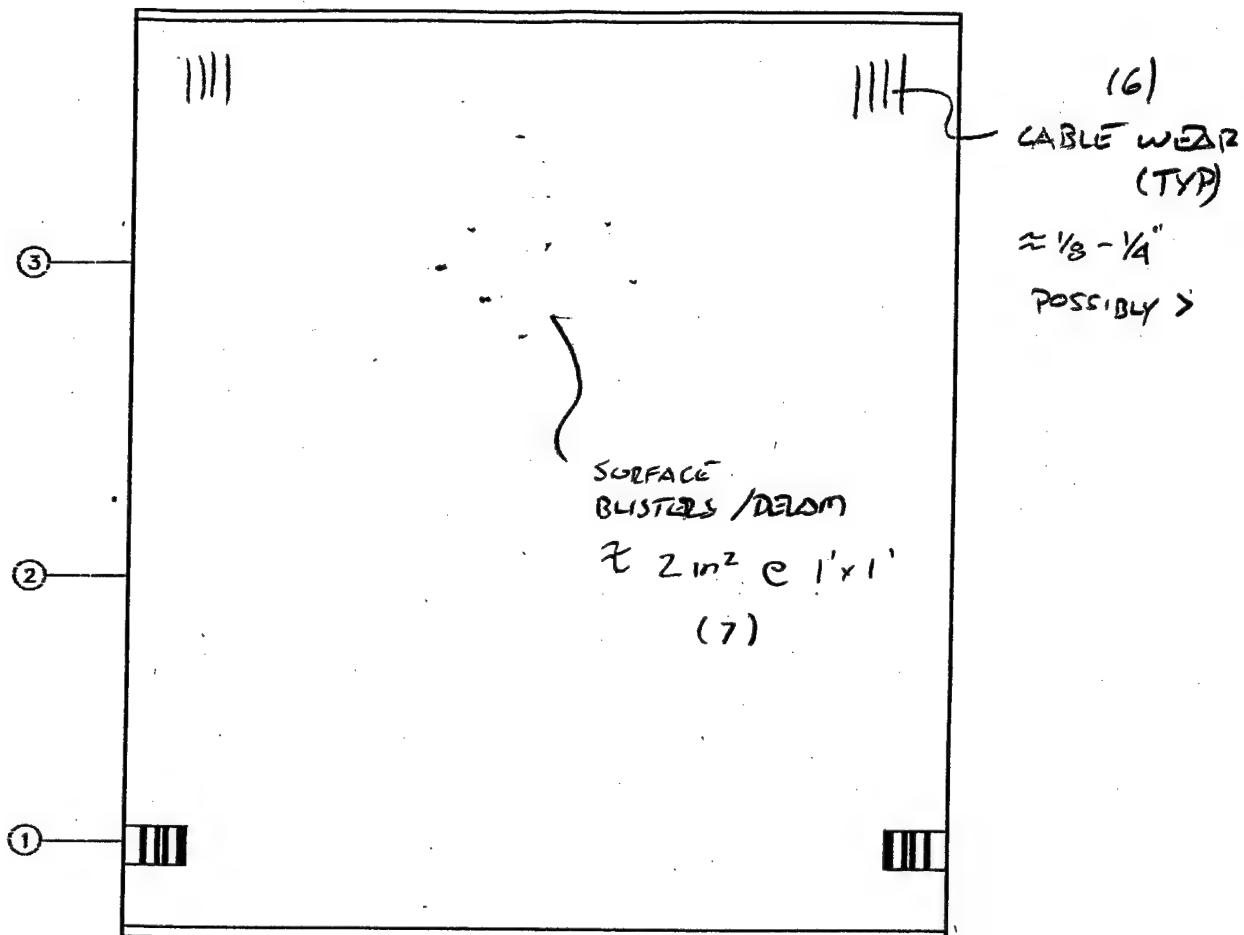
⑨ Leaking bottom seal

⑩ Leak in bottom seal, by pier

⑪ middle leak.

⑫ Leak in bottom seal, — left.

Gate No. 8 Upstream Elevation



DEEP PITTING UP TO 1/4" AT TOP

Gate No. 8 Operation and Trunnion Measurements

Racking Measurements: Bottom of Gate and Spillway

LEFT	RIGHT
26	25 3/8

Transverse Trunnion Hub Movement, No Load on Gate: Closed-Open-Closed

	LEFT		RIGHT	
	Inside	Outside (pier)	Inside	Outside (pier)
Initial Gate Closed	14/32	30/32	17/32	26/32
Gate Full Open	14/32	30/32	17/32	26/32
Final Gate Closed	14/32	30/32	17/32	26/32

3-D Trunnion Hub Movements - Unloaded vs. Loaded

	LEFT				RIGHT			
	No Load Void Dry		Full Load Void Full		No Load Void Dry		Full Load Void Full	
Vertical	0.0000		-0.0030					
US / DS	+0.0010		+0.0240					
Transverse	14/32	30/32	14/32	30/32	17/32	26/32	17/32	26/32
	Inside	Outside	Inside	Outside	Inside	Outside	Inside	Outside



**HDR Engineering, Inc.**  
Corp of Engineers - Walla Walla  
Lower Granite Dam

Inspection Team K & N  
Weather CLEAR

Date 10/04/00  
Sheet 1 OF 1

Gate No. 2

### Hoist Amperage Readings

Name Plate Data	WESTINGHOUSE	
Horsepower	15	
Voltage	460/3 PHASE/60 HZ	DESIGN C
Current	19.50	1760 RPM
Type	71D14371	
Frame	254T	

Amperage		Loaded		Unloaded	
		Opening	Closing	Opening	Closing
Starting		108.0	104.5	106.0	102.0
Running	Phase A	15.2	9.9	13.5	9.0
	Phase B	15.7	10.6	14.6	9.2
	Phase C	14.9	9.7	14.1	10

## RIGHT ANGLE GEAR BOX NOISY

Gate No. 3

**Hoist Amperage Readings**

Name Plate Data WESTINGHOUSE

Horsepower 15

Voltage 460/3 PHASE/60 HZ DESIGN C

Current 19.50 1760 RPM

Type 71D14371

Frame 254T

Amperage		Loaded		Unloaded	
		Opening	Closing	Opening	Closing
Starting		117.6	114.4	114.4	111.2
Running	Phase A	16.1	10.1	15.5	10.6
	Phase B	16.3	11.2	15.5	10.5
	Phase C	16.6	10.4	15.8	10.6

PRIMARY WORMGEAR REDUCER NOISY (SOUNDS DRY)

MAIN REDUCER HAS SEVERE LEAK (@ OUTPUT SHAFT ODE)

ODE (OPPOSITE DRIVE END)

Gate No. 4

**Hoist Amperage Readings**

Name Plate Data WESTINGHOUSE  
 Horsepower 15  
 Voltage 460/3 PHASE/60 HZ DESIGN C  
 Current 19.50 1760 RPM  
 Type 71D14371  
 Frame 254T

Amperage		Loaded		Unloaded	
		Opening	Closing	Opening	Closing
Starting		116.2	104.8	112.0	105.0
Running	Phase A	15.5	9.6	16.2	10.2
	Phase B	16.1	9.7	15.3	10.0
	Phase C	15.6	9.4	16.3	10.5

SIMILAR LEAKS TO UNITS 3

BEARING NOISE MOTOR SHAFT SIDE



Date **10/06/00**  
Sheet **1 OF 1**

### Hoist Amperage Readings

Name Plate Data	WESTINGHOUSE	
Horsepower	15	
Voltage	460/3 PHASE/60 HZ	DESIGN C
Current	19.50	1760 RPM
Type	71D14371	
Frame	254T	

Amperage		Loaded		Unloaded	
		Opening	Closing	Opening	Closing
Starting		108.8	112.0	115.0	111.2
Running	Phase A	15.0	9.6	14.1	10.1
	Phase B	15.9	10.5	14.7	10.1
	Phase C	16.9	10.2	14.7	10.4

SAME LUBE LEAKS & SEEPAGE AS OTHER UNITS  
OUTPUT SHAFT SEAL LEAKING DRIVE SHAFT SIDE

**HDR Engineering, Inc.**  
Corp of Engineers - Walla Walla  
Lower Granite Dam

Inspection Team K & N

Weather CLEAR

Date 10/03/00

Sheet 1 OF 1

**Gate No. 6**

### Hoist Amperage Readings

**Name Plate Data**      WESTINGHOUSE

**Horsepower** 15

**Voltage** 460/3 PHASE/60 HZ DESIGN C

<b>Current</b>	19.50	1760 RPM
----------------	-------	----------

Type 71D14371

**Frame** 254T

Amperage		Loaded		Unloaded	
		Opening	Closing	Opening	Closing
Starting		113.6	106.4	110.5	110.0
Running	Phase A	15.3	10.2	15.2	10.6
	Phase B	15.9	10.2	15.1	9.3
	Phase C	15.8	10.1	16.3	9.8

## TYPICAL LUBRICANT SEEPAGE TO OTHER UNITS

Date 10/04/00  
Sheet 1 OF 1

### Hoist Amperage Readings

Name Plate Data	WESTINGHOUSE	
Horsepower	15	
Voltage	460/3 PHASE/60 HZ	DESIGN C
Current	19.50	1760 RPM
Type	71D14371	
Frame	254T	

Amperage		Loaded		Unloaded	
		Opening	Closing	Opening	Closing
Starting		116.8	110.8	124.1	110.0
Running	Phase A	15.6	10.1	15.1	9.4
	Phase B	15.3	10.0	16.2	9.9
	Phase C	15.7	9.6	16.0	8.9

## NORMAL LUBE LEAKAGE

[illegible]

**HDR Engineering, Inc.**  
Corp of Engineers - Walla Walla  
Lower Granite Dam

Inspection Team K & N  
Weather CLEAR

Date 10/04/00  
Sheet 1 OF 1

**Gate No. 8**

### Hoist Amperage Readings

Name Plate Data	WESTINGHOUSE	
Horsepower	15	
Voltage	460/3 PHASE/60 HZ	DESIGN C
Current	19.50	1760 RPM
Type	71D14371	
Frame	254T	

Amperage		Loaded		Unloaded	
		Opening	Closing	Opening	Closing
Starting		114.0	108.0	110.4	110.6
Running	Phase A	15.3	10.4	16.3	10.9
	Phase B	16.0	9.8	14.8	10.1
	Phase C	15.7	9.8	14.8	10.

### LUBE SEEPAGE @ MOST BEARING, COUPLING LOCATIONS

**LARGE LEAK @ REDUCER OUTPUT SHAFT ODE W/BUILDUP ON DECK**

**KLEINFELDER***An employee owned company*

## Ultrasonic Testing Technique Report Steel Group

Client Name: HDR Engineering  
Project Name: Walla Walla Lower Granite Dam  
Contractor: HDR Engineering  
Technique Performed By: Destry K. Hall

UT Report No.: 1  
Date: October 2, 2000  
KA Project No.: 21-6149-01-001  
Client Contact: Wayne Edwards  
Level: 2

Type of Inspection (check one):      Straight Beam ☐      Angle Beam ☒      Other ☒  
If other please specify: Evaluation of moment resisting frames.

Drawings Referenced: Walla Walla District Corps of Engineers, Draft Scope Outline, Radial Gate Inspection, Analysis and Testing, Lower Granite Dam.

Equipment: Krautkramer Branson      USN 52L      s/n: 00D94J      Date of Calibration: 4/26/00

Transducer: SWS, Gamma, 2.25 X .75 X .625, BNC      s/n: 00CM4P      : Wedge, SF-AWS, 70 DEG.      s/n: 00D0JB

Test Block: IIW, Type 1, Steel : s/n: 7856      /      DSC, Steel : s/n: 98-6331

Method Used: Procedure # 1, Top quarter 70°, Middle half 70°, Bottom quarter 70°; Face A and Face B when possible

Scanning Method: Pattern E w/ A, B and C movement      Scanning Level: 20 dB above Zero Reference.

Material Type: ASTM A36 / ASTM A572

Temp. of Material: Ambient      Sensitivity Level: 80% FSH      Surface Condition: Tight adhering paint

Examination Standard: ASTM E 164-94      Acceptance Standard: AWS D1.5-95      NDT Procedure No.: KA-NDETP-UT-001

Quality requirements - section no. : AWS D1.5-98 Section # 9.21.3 and Table 9.1; and Section 9 Part C

Weld joint AWS: TC-U5-GF, TC-U4b-GF, B-U4b-GF, B-U5-GF      Welding process : GMAW / FCAW / SMAW

Material Thickness : 3/4 through 1-5/8

Weld identification: Each weld was identified on drawings by HDR Representative Sam Planck; All testing was performed for information only.

**CERTIFICATION PAPERS ARE AVAILABLE UPON REQUEST.**

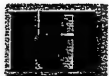
We, the undersigned, certify that the statements in this record are correct and that the welds were prepared and tested in accordance with the requirements of ANSI/AASHTO/AWS D1.5 (1995) Bridge Welding Code.  
year

**Kleinfelder, Inc.**

Inspector Signature: 

Inspector Name: Destry K. Hall

Page 1 of 10.

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**ULTRASONIC TEST REPORT**

CLIENT NAME HDR Engineering  
PROJECT NAME Walla Walla; Lower Granite Dam  
CONTRACTOR C.O.E  
GATE NO.: 1 through 8

DATE: 10-2/10-13/00  
PROJECT NO.: 21-6149-01  
UT REPORT NO.: 001  
PAGE 2 OF 10

**REPORT OF ULTRASONIC TESTING OF MATERIALS**

COUPLANT	Ultragel II	INSTRUMENT SN#:	00D94J	JOINT DESCRIPTION:	
CAL BLOCK SN#	IIW (7856)	REFERENCE LEVEL:	48 Db	BUTT JOINT:	B-U4b-GF / B-U5-GF
TRANSDUCER SN#	00CM4P	SCANNING LEVEL:	+20 Db	CORNER JOINT:	TC-U5-GF
ANGLE/MODE:	70 & 60 deg.	SURFACE CONDITION:	Painted	T-JOINT:	TC-U4b-GF
ACCEPT CRITERIA AWS TBL:	9.1	MATERIAL THICKNESS:	3/4" / 1-5/8"	COMMENTS: Welding process used: SMAW/GMAW/FCAW. Tested through painted surface. Information only.	
EXAMINATION FROM FACE:	A & B	VOLUMETRIC EXAM IN LEG:			
ZERO DEGREE TRANSDUCER:		DIAMETER: 1"	FREQUENCY: 2.25 Mhz		

ITEMS EXAMINED / TESTED: 3-strut arm splices and center strut mid-span splice  
ITEM DESIGNATION: Gate 1, Gate 2, Gate 3, Gate 4, Gate 5, Gate 6, Gate 7 and Gate 8  
Strut 1(a), Strut 2(a), Strut 3(a), Trunnion (a), Strut 1(b), Strut 2(b), Strut 3(b) and Trunnion (b),

WELD IDENTIFICATION	ACCEPTED	REJECTED	REMARKS
1. Gate 1	41	3	
2. Gate 2	42	2	
3. Gate 3	37	7	
4. Gate 4	27	17	
5. Gate 5	41	3	
6. Gate 6	41	3	
7. Gate 7	29	15	
8. Gate 8	40	4	
9.			
10.			

TOTAL WELDS TESTED: 352

COMMENTS and/or SKETCH:

TOTAL WELDS ACCEPTED: 298TOTAL WELDS REJECTED: 54**KLEINFELDER**

5880 District Boulevard; Suite 24, Bakersfield, CA 93313

(661) 831-2155 (661) 831-1937 fax

**KLEINFELDER***An employee owned company*

## ULTRASONIC TEST REPORT

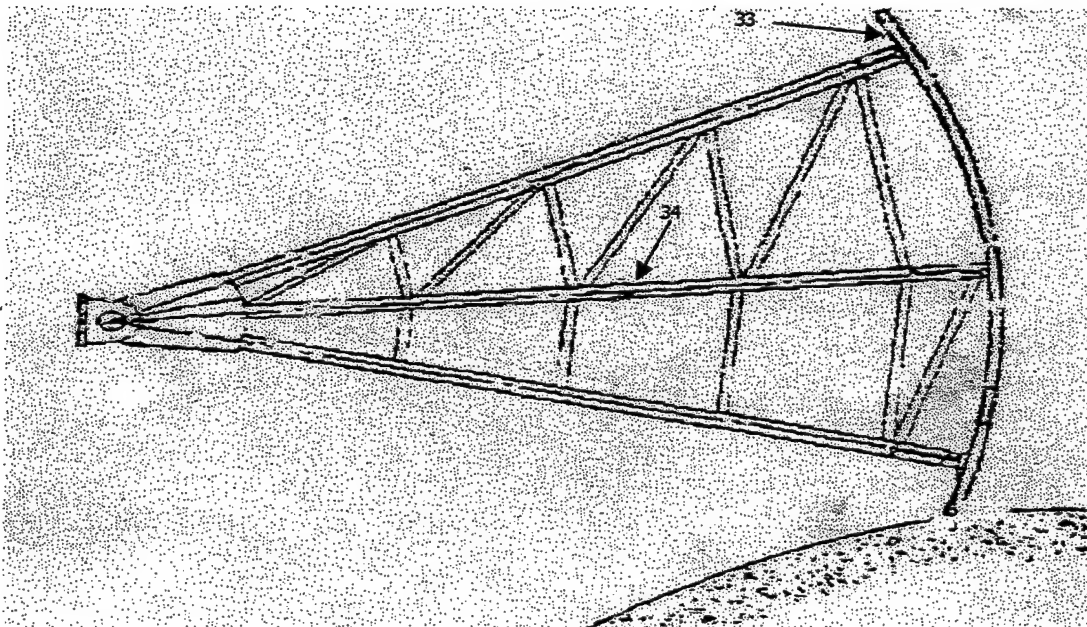
### GATE 1

PROJECT NAME Walla Walla; Lower Granite Dam  
PROJECT NO.: 21-6149-01

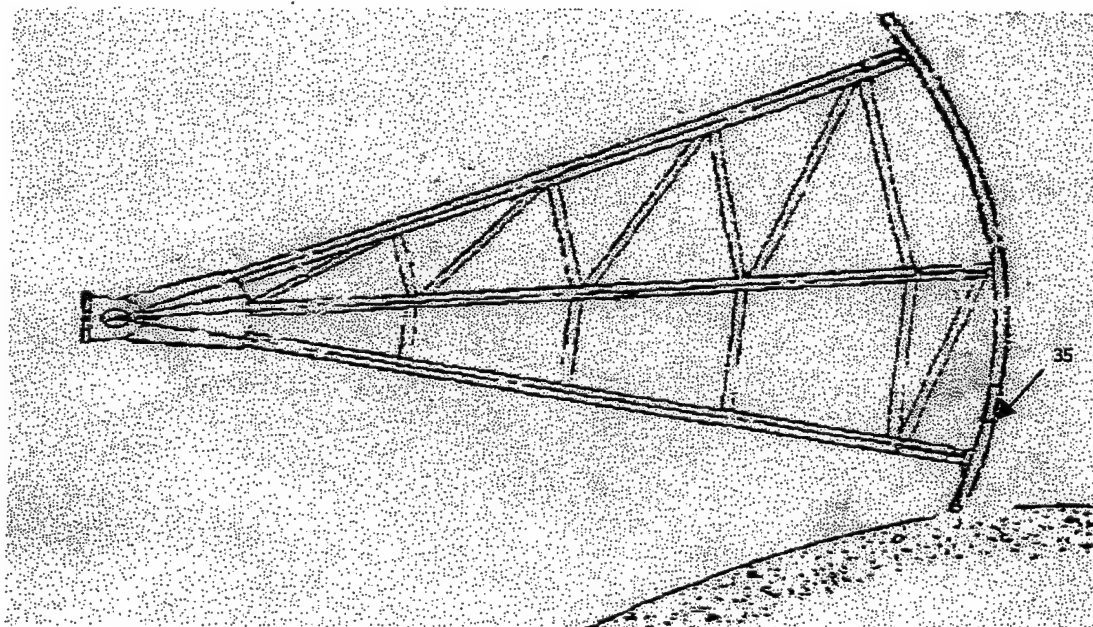
DATE: 10-2/10-13/00  
PAGE 3 of 10

#### INFORMATION ON REJECTED WELDS

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG°	DECIBALS				DISCONTINUITY				Discontinuity Evaluation	Remarks	
					Indication Level	Reference Level	Attenuation Factor	Indication Rating	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE			
												From X			From Y
1	336	70	A	1 & 2	52dB	48 Db	.562	3.438	1.25	1.281	.832			B	
2	346	70	A	1 & 2	54dB	48 Db	2.794	3.206	2.625	2.397	1.296			B	
3	356	70	A	1 & 2	49dB	48 Db	1.594	-.594		1.797	1.034			A	
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															



**GATE 1 (Outer Left)**



**GATE 1 (Inner Right)**



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## ULTRASONIC TEST REPORT

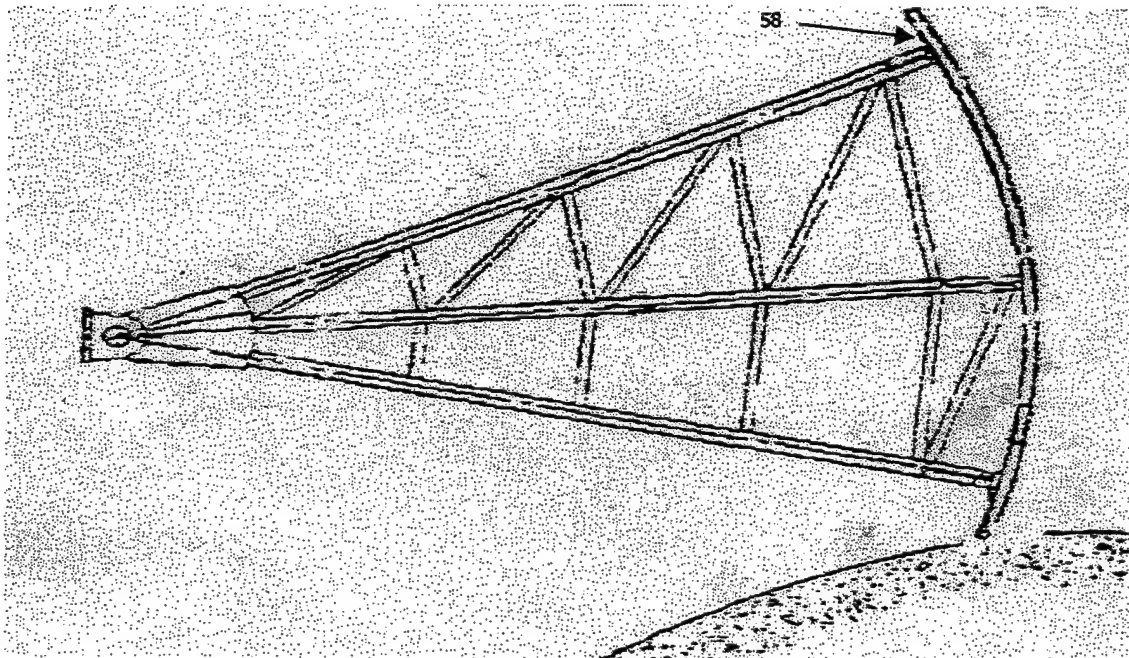
### GATE 2

PROJECT NAME Walla Walla; Lower Granite Dam  
PROJECT NO.: 21-6149-01

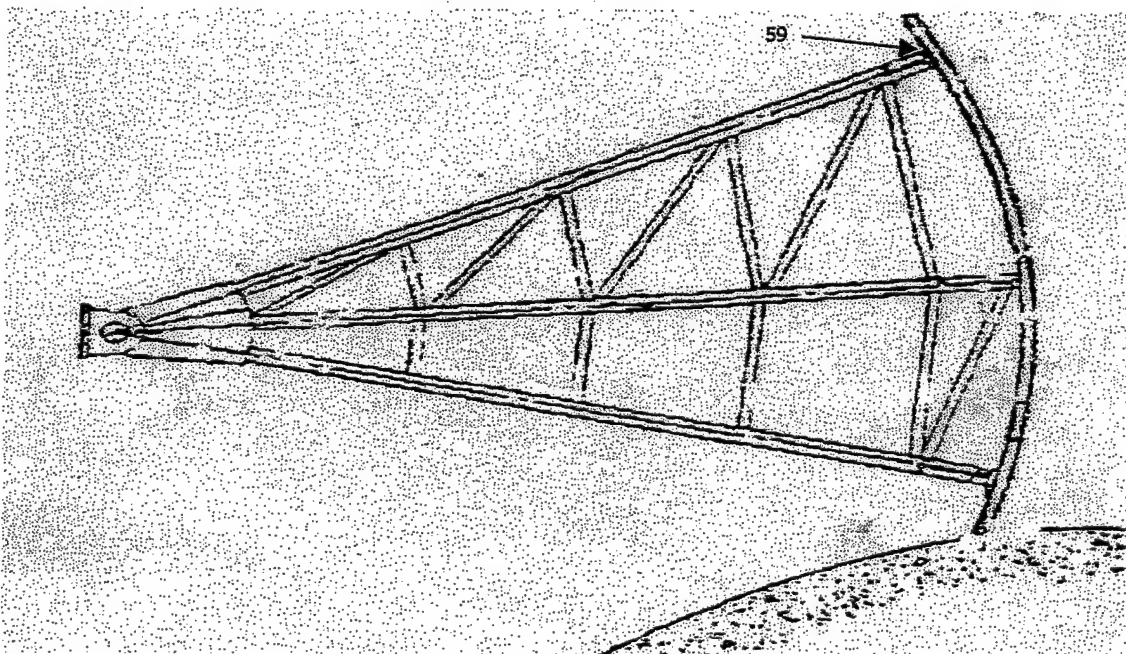
DATE: 10-2/10-13/00  
PAGE 4 of 10

#### INFORMATION ON REJECTED WELDS

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG°	DECIBALS				DISCONTINUITY				Discontinuity Evaluation	Remarks	
					Indication Level	Reference Level	Attenuation Factor	Indication Rating	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE			
												From X			From Y
1	58fo	70	A	1 + 2	48db	48db	5.016	-5.016		3.508	1.200			A	
2	59fo	70	A	1 + 2	52dB	48db	4.886	-886		3.443	1.178			A	
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															



**GATE 2 (Outer Left)**



**GATE 2 (Inner Right)**

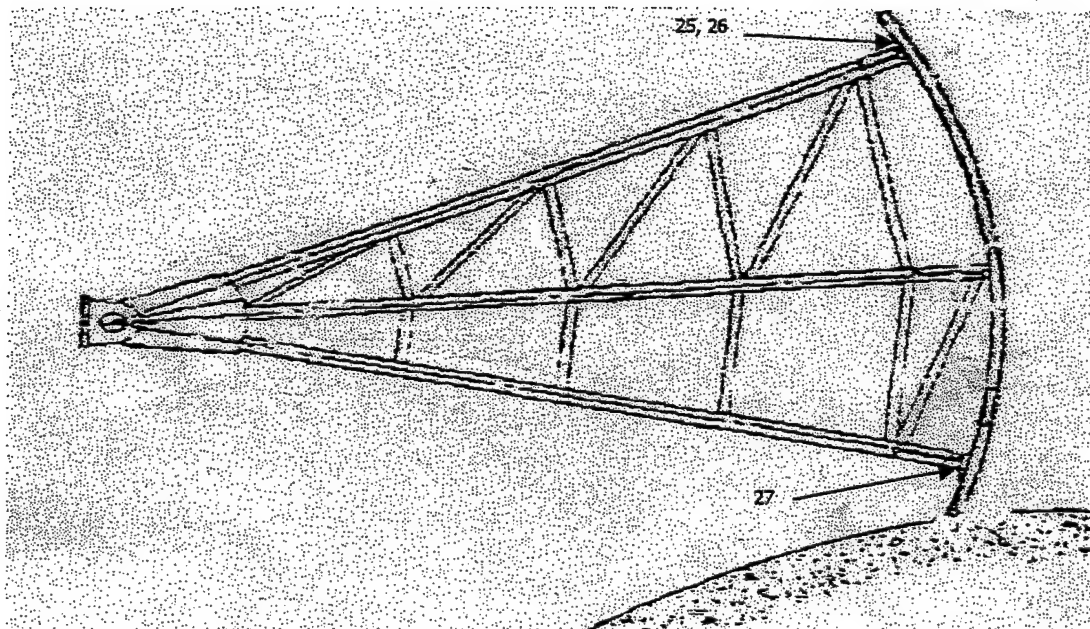
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# ULTRASONIC TEST REPORT

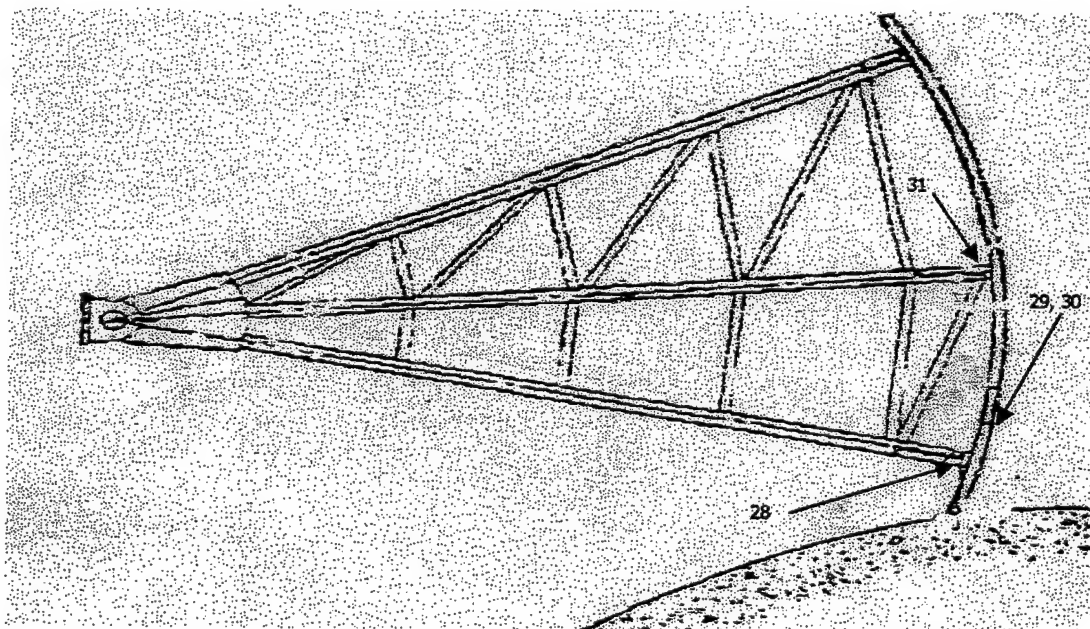
## GATE 3

PROJECT NAME: Walla Walla; Lower Granite Dam  
PROJECT NO.: 21-6149-01DATE: 10-2/10-13/00  
PAGE: 5 of 10**INFORMATION ON REJECTED WELDS**

INFORMATION ON REJECTED WELDS															
LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG°	DECIBELS				DISCONTINUITY				Discontinuity Evaluation	Remarks	
					Indication Level	Reference Level	Attenuation Factor	Indication Rating	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE			
												From X			From Y
1	25f	70	A	1 & 2	50dB	48 Db	1.014	.986		1.507	.758			A	
2	26w	70	A	1 & 2	54dB	48 Db	4.35	1.65		3.175	1.034			A	
3	27f	70	A	1 & 2	52dB	48 Db	4.048	1.048		3.004	1.234			A	
4	28f	70	A	1 & 2	48dB	48 Db	1.268	1.268		1.634	.978			A	
5	29f	70	A	1 & 2	50dB	48 Db	1.718	.282		1.859	.937			A	
6	30f	70	A	1 & 2	54dB	48 Db	3.014	2.98	1.125	2.507	.878			B	
7	31w	70	A	1 & 2	54dB	48 Db	3.906	2.094	1.875	2.253	1.178			A	
8							3.906	2.094							
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															



**GATE 3 (Outer Left)**



**GATE 3 (Inner Right)**

**KLEINFELDER**

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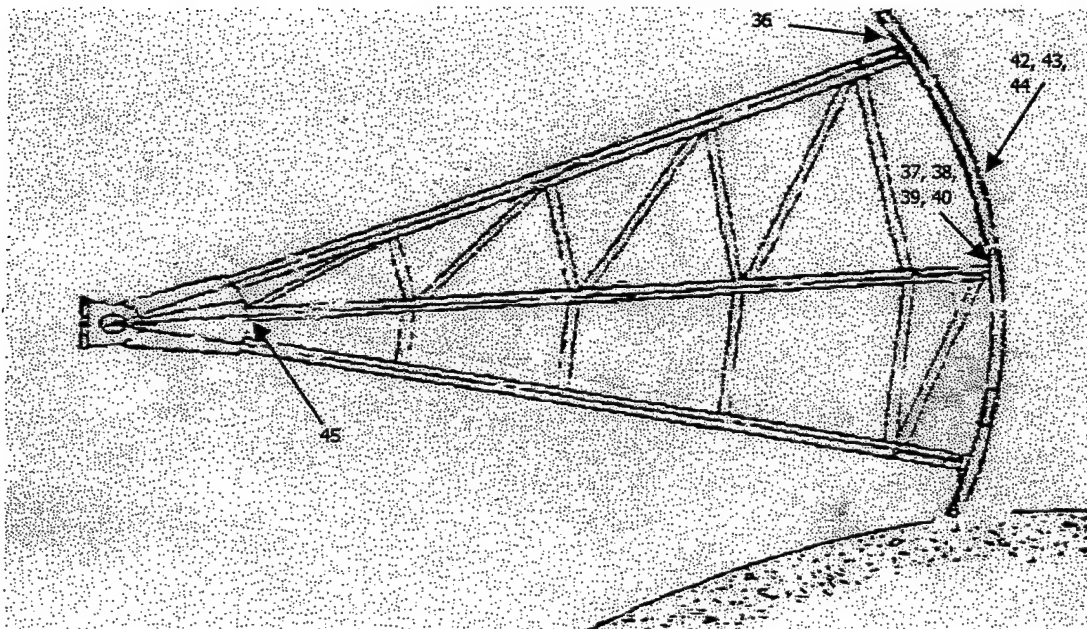
# ULTRASONIC TEST REPORT

## GATE 4

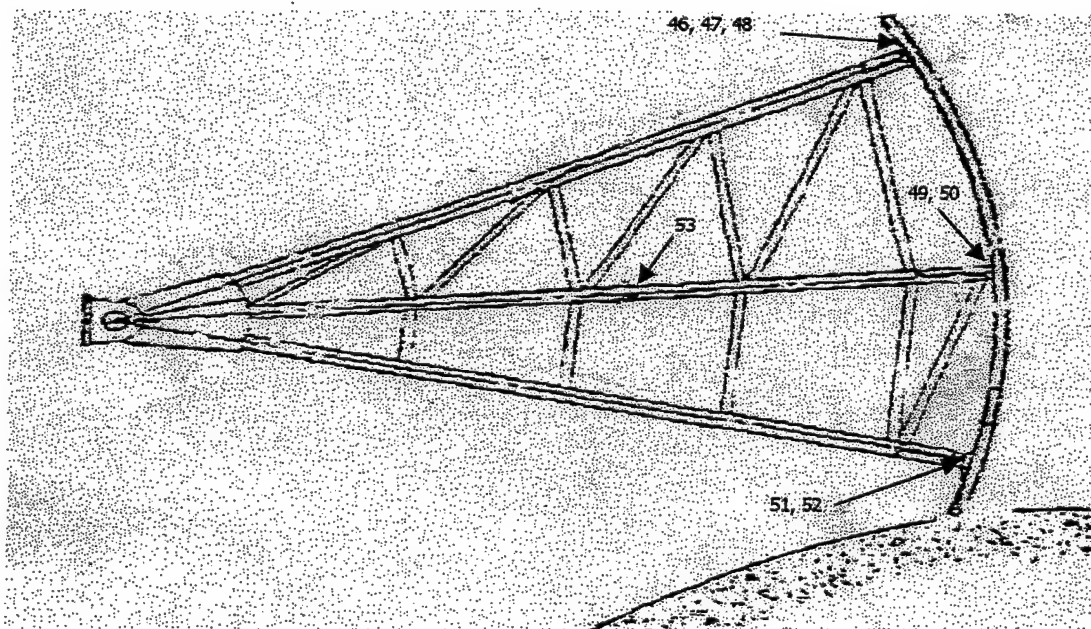
PROJECT NAME Walla Walla; Lower Granite Dam  
PROJECT NO.: 21-6149-01DATE: 10-2/10-13/00  
PAGE 6 of 10**INFORMATION ON REJECTED WELDS**

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG°	DECIBELS				DISCONTINUITY				Discontinuity Evaluation	Remarks	
					Indication Level	Reference Level	Attenuation Factor	Indication Rating	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE			
												From X			From Y
1	36w	70	A	1 + 2	54dB	48dB	3.906	2.094		2.953	1.010			A	
2	37fo	70	A	1 + 2	54dB	48dB	.802	6.802	1.5	.599	.205			D	Acceptable
3	38fi	70	A	1 + 2	54dB	48dB	5.01	.99		3.505	1.198			A	
4	39fi	70	A	1 + 2	54dB	48dB	4.35	1.65		3.175	1.086			A	
5	40fi	70	A	1 + 2	54dB	48dB	4.542	1.458		3.271	1.119			A	
6	42fo	70	A	1 + 2	54dB	48dB	-.404	6.404	3.5"	.798	.272			D	Acceptable
7	43w	70	A	1 + 2	54dB	48dB	.562	5.438	2.5"	1.281	.438			D	Acceptable
8	44fi	70	A	1 + 2	50dB	48dB	-.294	2.294	.375"	.853	.285			A	
9	45w	70	A	1 + 2	54dB	48dB	2.542	3.458	.375"	2.271	.777			B	Acceptable by length
10	46fo	70	A	1 + 2	48dB	48dB	5.582	-5.582		3.791	1.296			A	
11	47fi	70	A	1 + 2	54dB	48dB	2.794	3.206	.875"	2.397	.820			B	
12	48w	70	A	1 + 2	50dB	48dB	3.014	-1.014		2.507	.857			A	
13	49fo	70	A	1 + 2	49dB	48dB	-.406	1.406		.797	.272			A	HAZ
14	50fo	70	A	1 + 2	48dB	48dB	.026	-.026		1.013	.346			A	HAZ
15	51fo	70	A	1 + 2	48dB	48dB	1.706	.294		1.853	.875			A	ind. out of gate, 60% fsh
16	52fi	70	A	1 + 2	49dB	48dB	5.788	-4.788		3.894	1.331			A	
17	53fo	70	A	1 + 2	48dB	48dB	4.158	-4.158		3.079	1.053			A	
18															
19															
20															

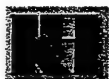




**GATE 4 (Outer Left)**



**GATE 4 (Inner Right)**

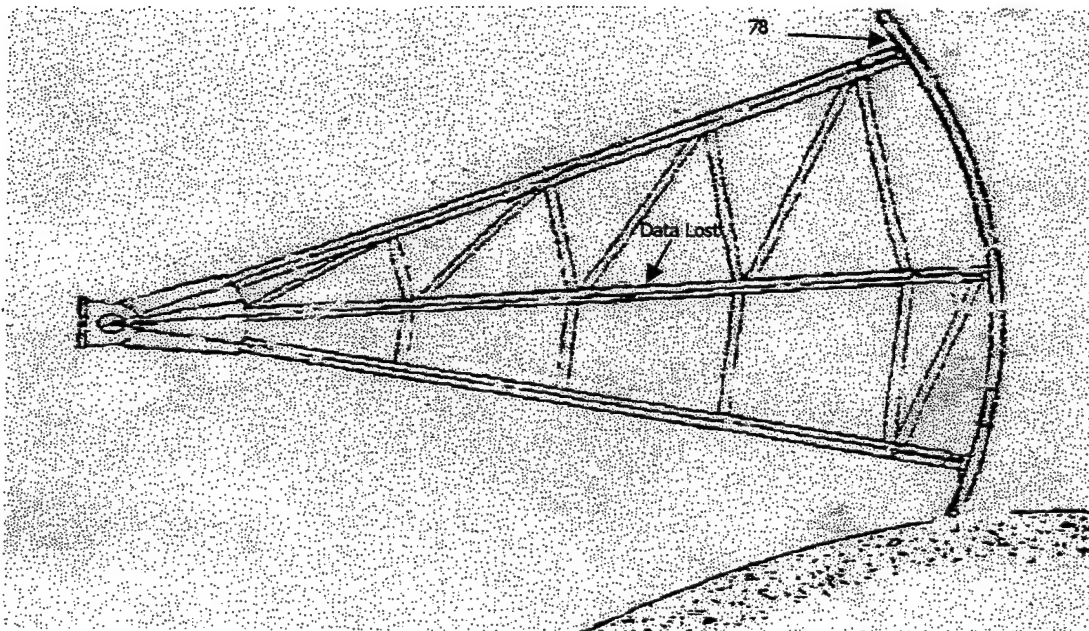
**KLEINFELDER***An employee owned company*

## ULTRASONIC TEST REPORT

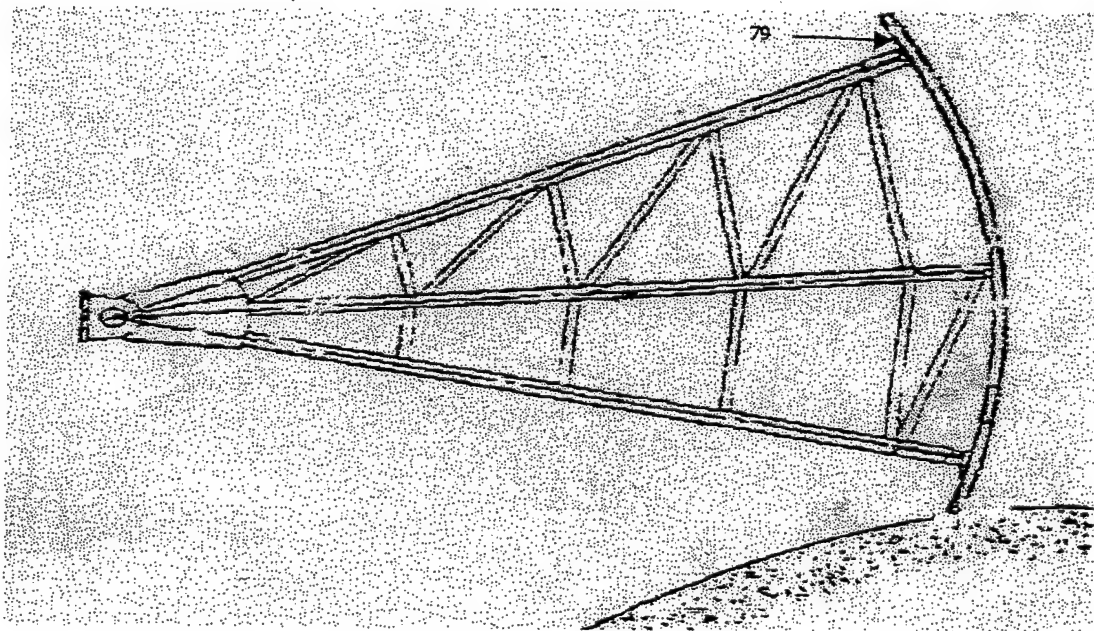
### GATE 5

PROJECT NAME Walla Walla; Lower Granite Dam  
PROJECT NO.: 21-6149-01DATE: 10-2/10-13/00  
PAGE 7 of 10**INFORMATION ON REJECTED WELDS**

INFORMATION ON REJECTED WELLS															
LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG	DECIBALS				DISCONTINUITY				Discontinuity Evaluation	Remarks	
					Indication Level	Reference Level	Attenuation Factor	Indication Rating	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE			
												From X			From Y
1	78fi	70	A	1 + 2	50dB	48dB	3.118	-1.118	3.5"	2.559	.857			A	
2	79fi	70	A	1 + 2	52dB	48dB	2.652	1.348	.850	2.326	.855			A	no data logged
3	80fi	70	A	1 + 2	52dB	48dB	4.084	-.084		3.024	1.034			A	
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															

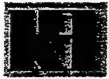


**GATE 5 (Outer Left)**



**GATE 5 (Inner Right)**



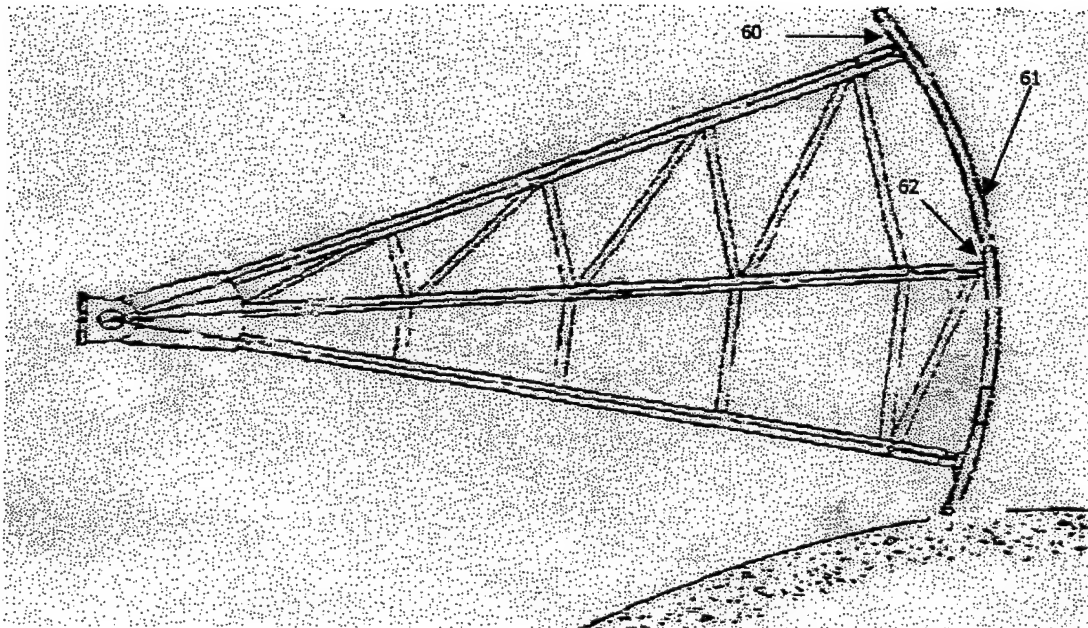
**KLEINFELDER***An employee owned company*

## ULTRASONIC TEST REPORT

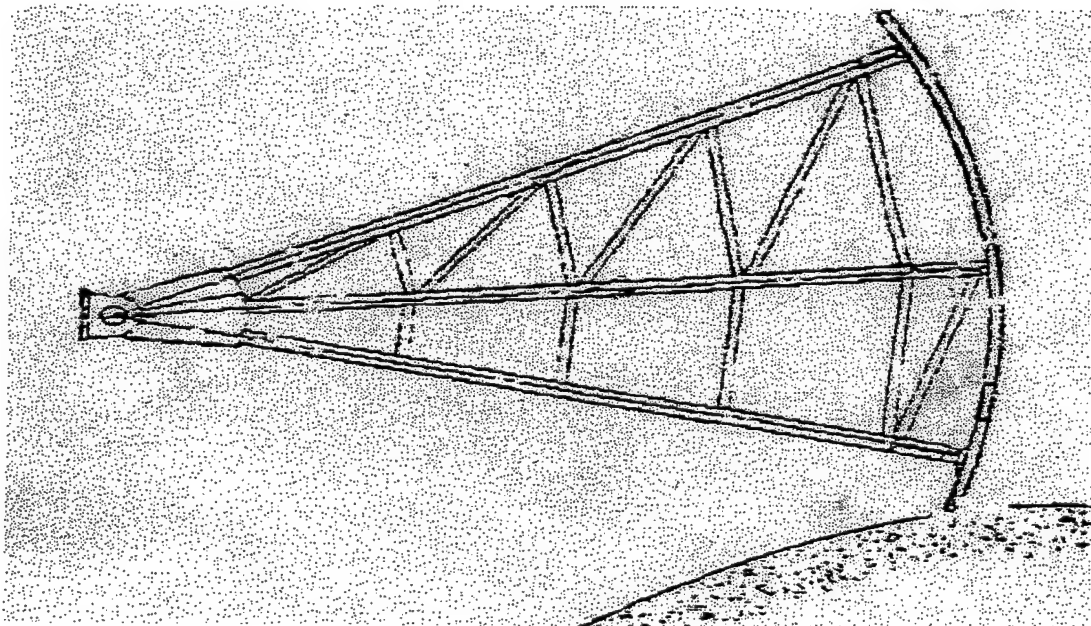
### GATE 6

PROJECT NAME Walla Walla; Lower Granite Dam  
PROJECT NO.: 21-6149-01DATE: 10-2/10-13/00  
PAGE 8 of 10**INFORMATION ON REJECTED WELDS**

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG	DECIBALS				DISCONTINUITY				Discontinuity Evaluation	Remarks	
					Indication Level	Reference Level	Attenuation Factor	Indication Rating	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE			
												From X			From Y
1	60fo	70	A	1 + 2	48dB	48dB	1.67	-1.67	2.75"	1.835	.897			A	no data logged
2	61fo	70	A	1 + 2	50dB	48dB	-272	2.272	full	.864	.295			B	
3	62fi	70	A	1 + 2	50dB	48dB	4.67	-2.67	3.5"	3.335	1.141			A	
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															



**GATE 6 (Inner Right)**



**GATE 6 (Outer Left)**

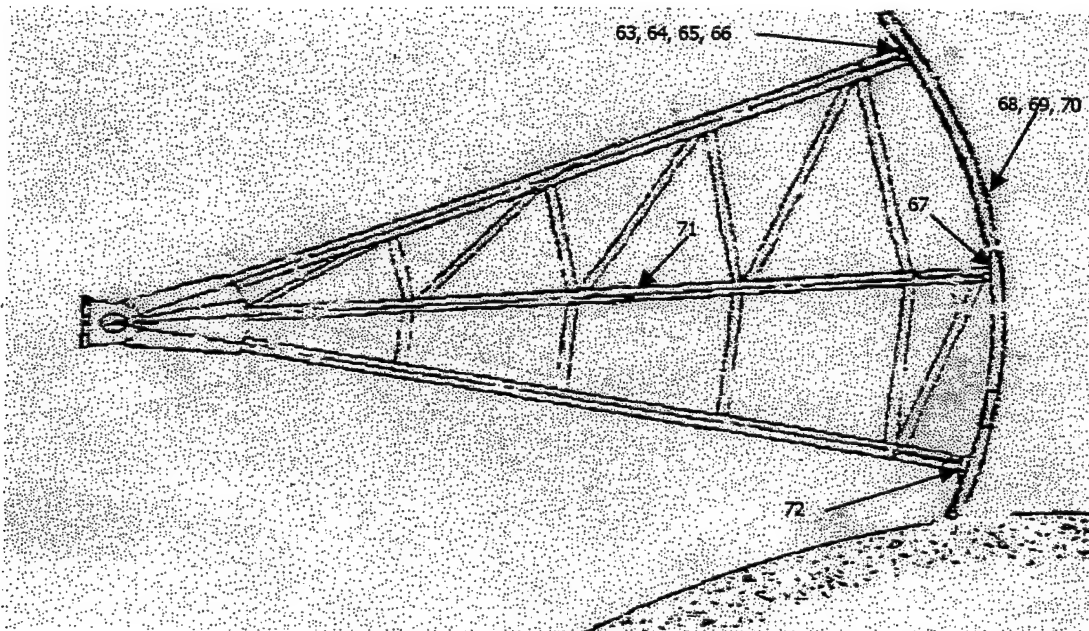
**KLEINFELDER***An employee owned company*

# ULTRASONIC TEST REPORT

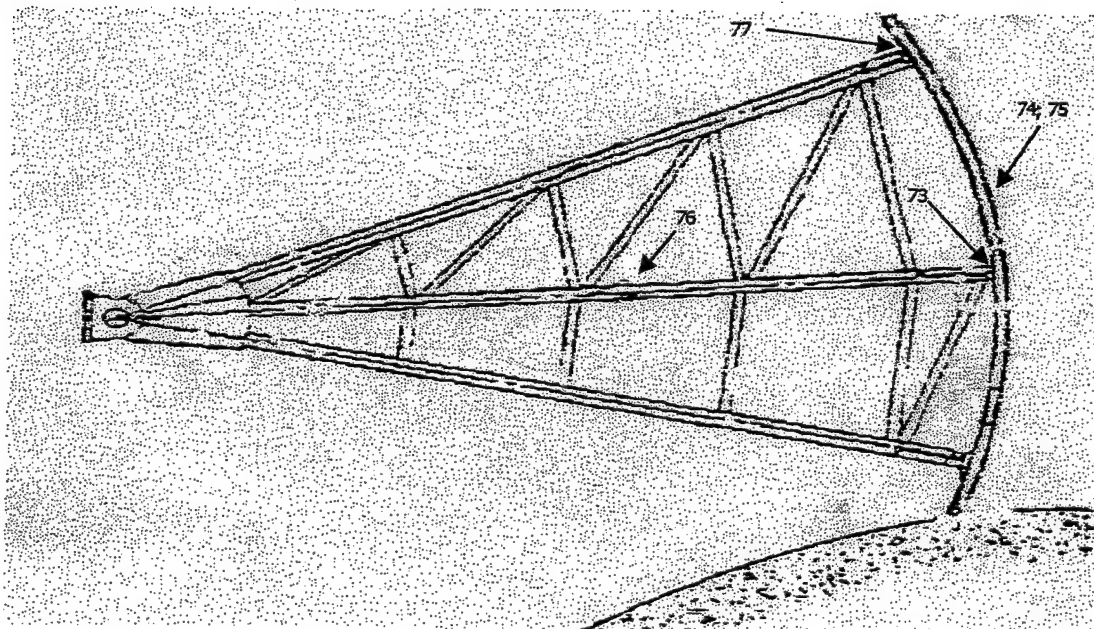
## GATE 7

PROJECT NAME Walla Walla; Lower Granite Dam  
PROJECT NO.: 21-6149-01DATE: 10-2/10-13/00  
PAGE 9 of 10**INFORMATION ON REJECTED WELDS**

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG°	DECIBELS				DISCONTINUITY				Discontinuity Evaluation	Remarks	
					Indication Level	Reference Level	Attenuation Factor	Indication Rating	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE			
												From X			From Y
1	63fo	70	A	1 + 2	48dB	48dB	5.664	-5.664		3.832	1.310			A	
2	64fo	70	A	1 + 2		48dB									no data logged
3	65fi	70	A	1 + 2	48dB	48dB	5.944	-5.944		3.972	1.343			A	
4	66w	70	A	1 + 2	48dB	48dB	4.694	-4.694		3.347	1.144			A	
5	67fi	70	A	1 + 2	48dB	48dB	4.416	1.584		3.308	1.131			A	
6	68fi	70	A	1 + 2	48dB	48dB	-.118	.118		.941	.322			A	
7	69w	70	A	1 + 2	44dB	48dB	-.608	-3.392		.696	.238			A	
8	70fo	70	A	1 + 2	49dB	48dB	-.312	1.312		.844	.298			A	
9	71fi	70	A	1 + 2		48dB									no data logged
10	72fo	70	A	1 + 2	48dB	48dB	1.298	-1.298		1.649	.564			A	
11	73fi	70	A	1 + 2		48dB									no data logged
12	74w	70	A	1 + 2	48dB	48dB	-.704	.704		.648	.222			A	
13	75fo	70	A	1 + 2	48dB	48dB	-.256	.256		.872	.298			A	
14	76w	70	A	1 + 2	48dB	48dB	.734	-.734		1.367	.467			A	
15	77fo	70	A	1 + 2	50dB	48dB	3.002	-1.002		2.501	.855			A	
16															
17															
18															
19															
20															



**GATE 7 (Outer Left)**



**GATE 7 (Inner Right)**

**KLEINFELDER**

An employee owned company

# ULTRASONIC TEST REPORT GATE 8

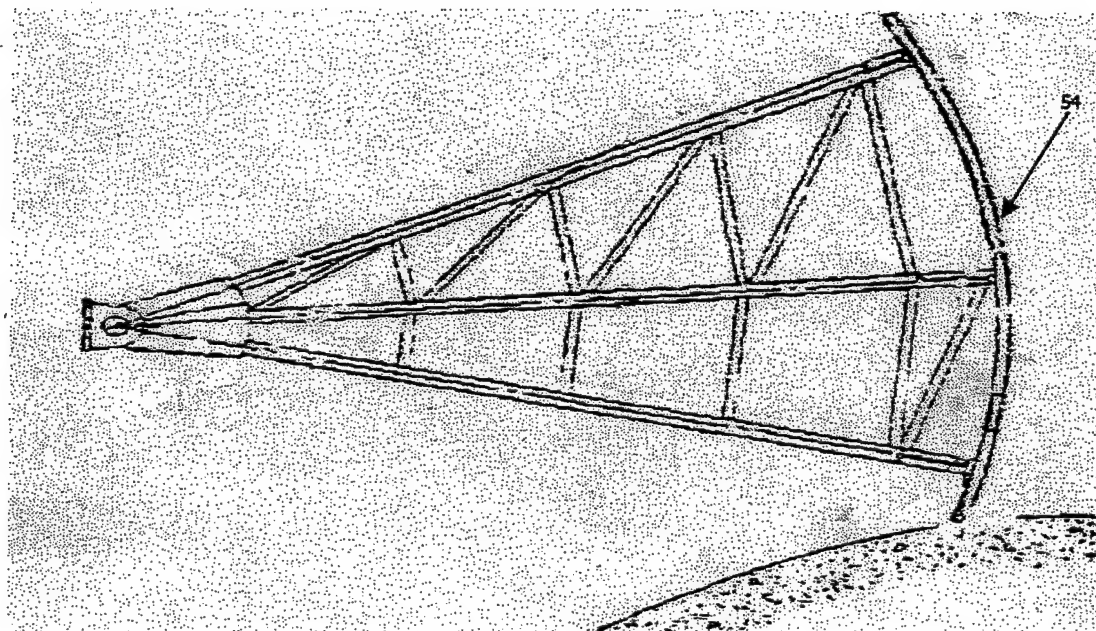
PROJECT NAME: Walla Walla; Lower Granite DamDATE: 10-2/10-13/00PROJECT NO.: 21-6149-01PAGE: 10 of 10**INFORMATION ON REJECTED WELDS**

LINE NUMBER	INDICATION NUMBER	TRANSDUCER ANGLE	FROM FACE	LEG	DECIBELS				DISCONTINUITY				Discontinuity Evaluation	Remarks	
					Indication Level	Reference Level	Attenuation Factor	Indication Rating	Length	Angular Distance (Sound Path)	Depth from "A" Surface	DISTANCE			
												From X			From Y
1	54	70	A	1 + 2	48dB	48dB	.016	-.016	2"	.922	.315			A	
2	55w	70	A	1 + 2	50dB	48dB	1.9	.1	1.125"	1.950	.667			A	
3	56fi	70	A	1 + 2	48dB	48dB	-.246	.246		.877	.300			A	
4	57w	70	A	1 + 2	48dB	48dB	3.196	-3.196	2.75"	2.598	.888			A	
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															

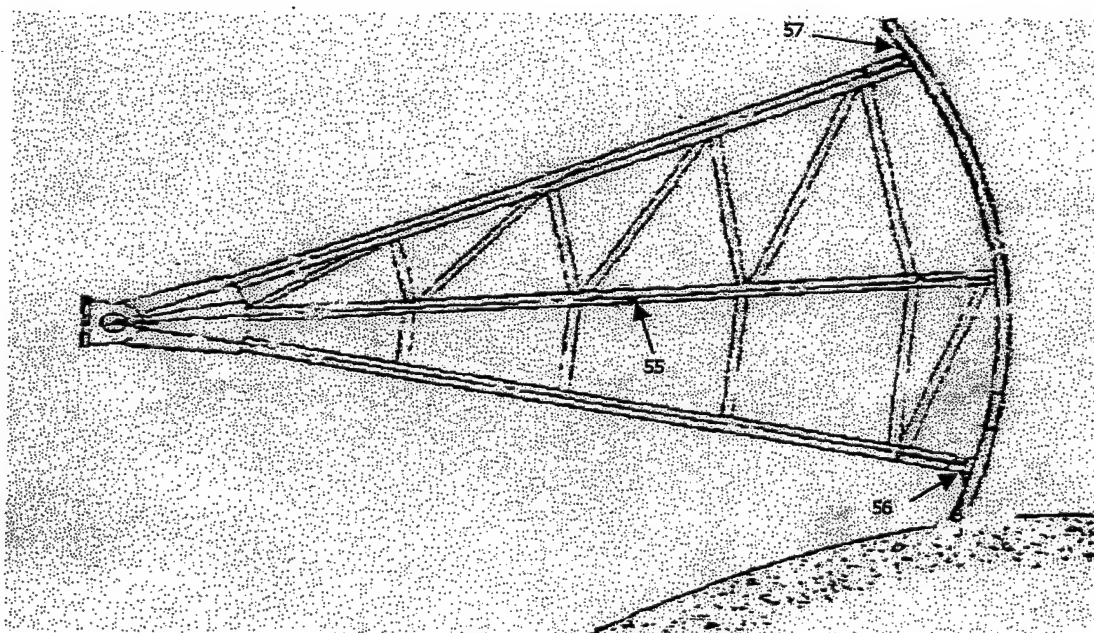
We the undersigned, certify the statements in this record are correct and the welds were prepared and tested in accordance with the requirements of ANSI/AASHTO/AWS D1.5 (1995) Bridge Welding Code.

year

INSPECTED BY: Destry K. Hall / Jim FisherASNT LEVEL: 2 / 2SIGNATURE: TEST DATE: 10-2/10-13/00



**GATE 8 (Inner Right)**



**GATE 8 (Outer Left)**





Lower  
Granite  
Dam

10/06/00

1-1

#### Gate 1

Top horizontal girder, right side,  
between stiffeners at radial strut  
connection. Delaminated paint and  
light corrosion due to poor drainage.



Lower  
Granite  
Dam

10/06/00

1-2

#### Gate 1

Top horizontal girder, right side,  
between stiffeners at radial strut  
connection. Delaminated paint and  
light corrosion due to poor drainage.



Lower  
Granite  
Dam

Gate 1  
Side seal leak, left side.

10/06/00

1-3



Lower  
Granite  
Dam

Gate 1  
Middle horizontal girder, right side,  
between stiffeners at radial strut  
connection. Delaminated paint and  
light corrosion due to poor drainage.

10/06/00

1-4





Lower  
Granite  
Dam

10/06/00

1-5

#### Gate 1

Upstream end, bottom radial strut.  
Ponding water between strut flanges  
and horizontal girder flange due to  
poor drainage.



Lower  
Granite  
Dam

10/06/00

1-6

#### Gate 1

Left end of bottom horizontal girder.  
Standing water, no drainage between  
multiple stiffeners. Horizontal girder  
to skin plate stiffeners, standing  
water, debris and no drainage

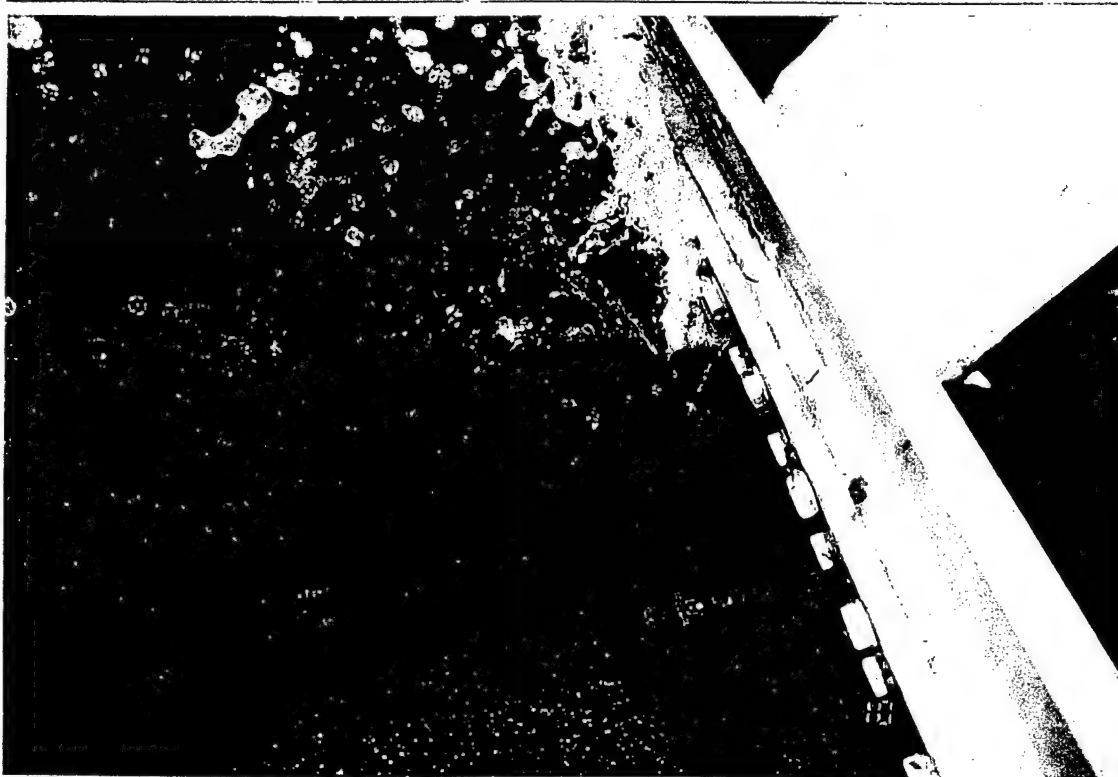


Lower  
Granite  
Dam

10/06/00

1-7

Gate 1  
Bottom seal closure plate looking  
upstream. Standing water between  
closure plate, purlin webs and  
skinplate. Typical.

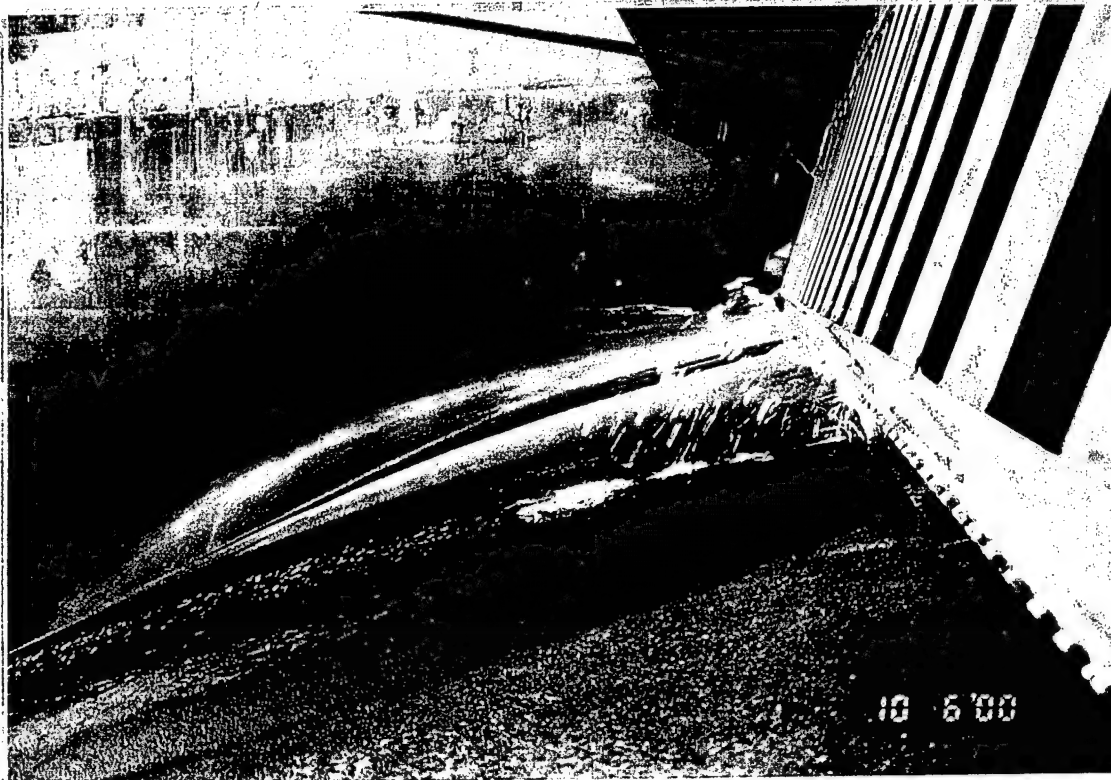


Lower  
Granite  
Dam

10/06/00

1-8

Gate 1  
Leak at center construction joint in  
spillway monolith.

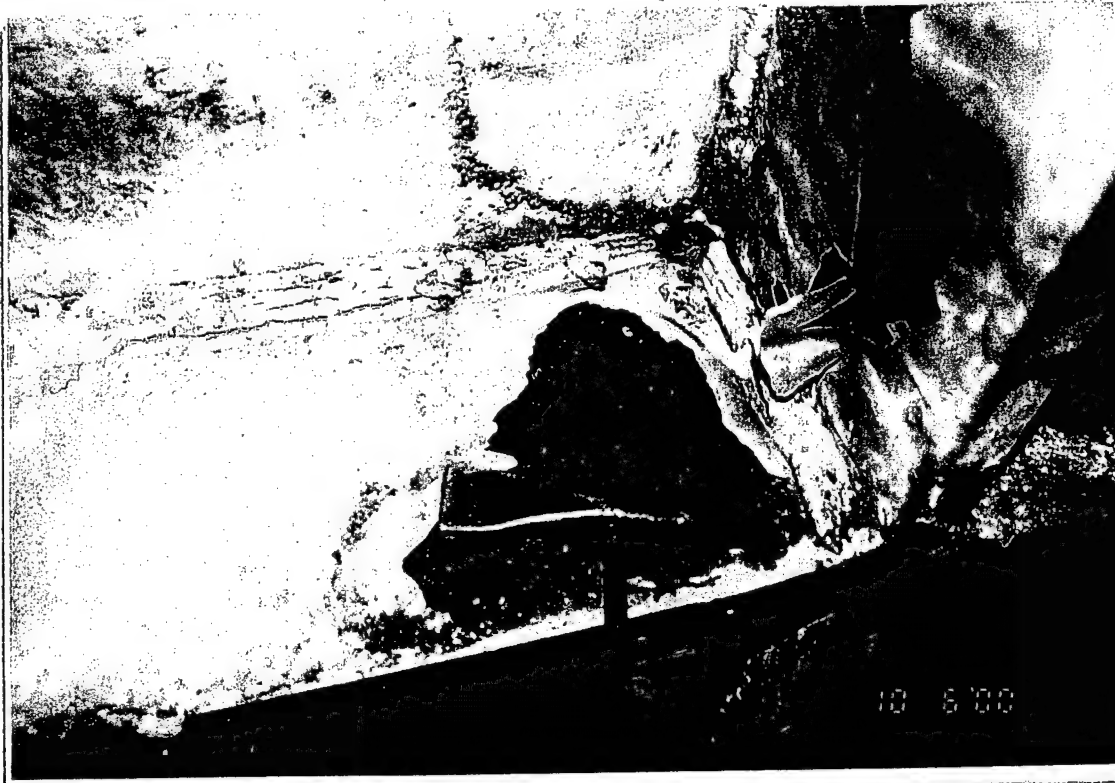


Lower  
Granite  
Dam

**Gate 1**  
Leak at center construction joint in  
spillway monolith.

10/06/00

1-9

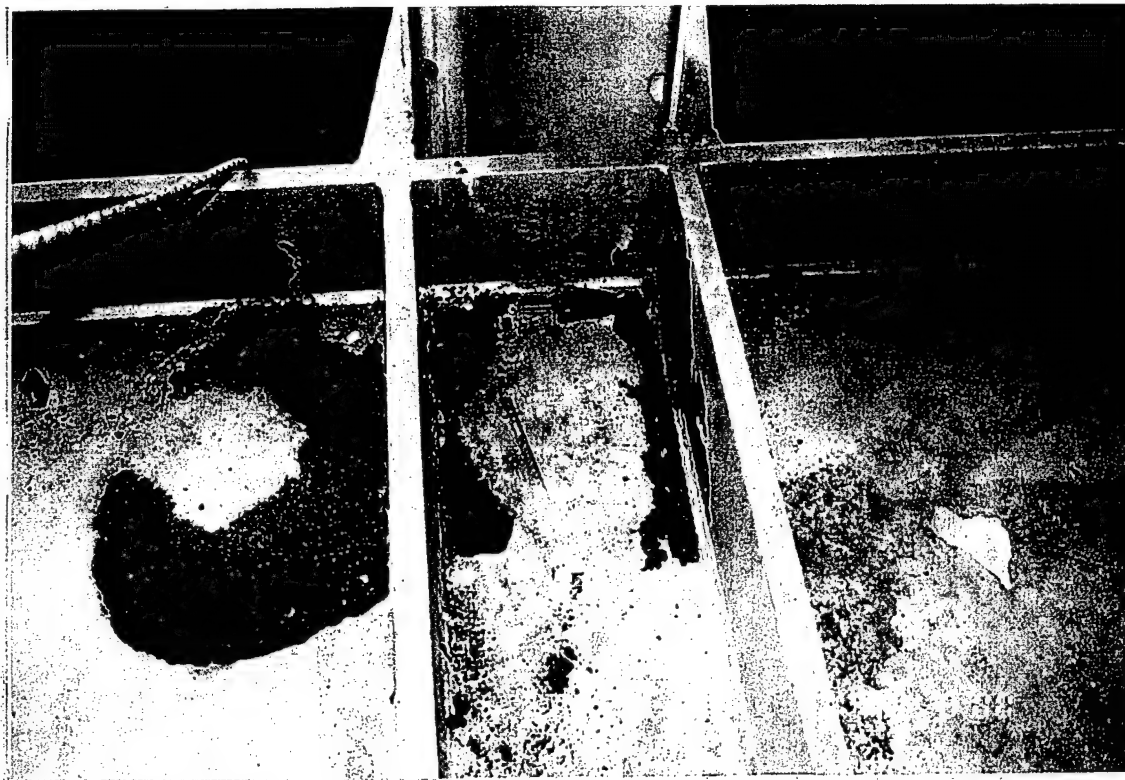


Lower  
Granite  
Dam

**Gate 1**  
Bottom of bottom horizontal girder at  
radial strut stiffeners. Delaminated  
paint, light corrosion on girder flange  
and stiffener plates. Typical.

10/06/00

1-10



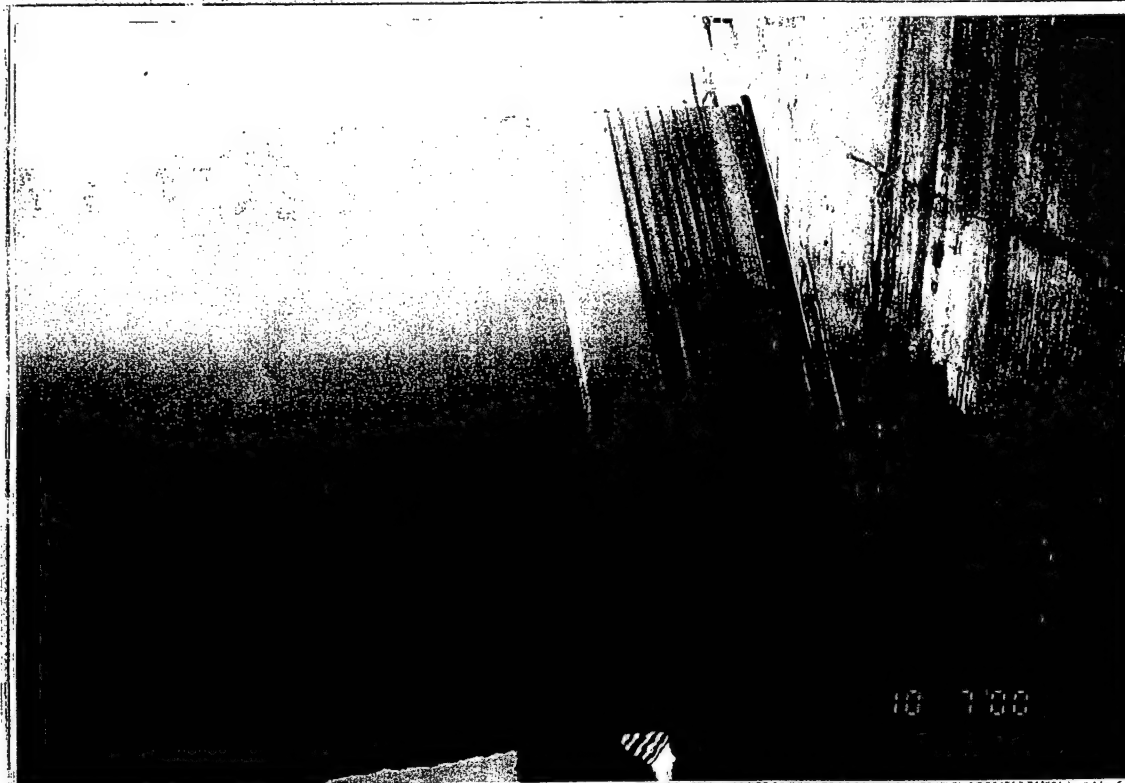
Lower  
Granite  
Dam

10/06/00

1-11

Gate 1

Top horizontal girder, right side,  
between stiffeners at radial strut  
connection. Delaminated paint and  
light corrosion due to poor drainage.



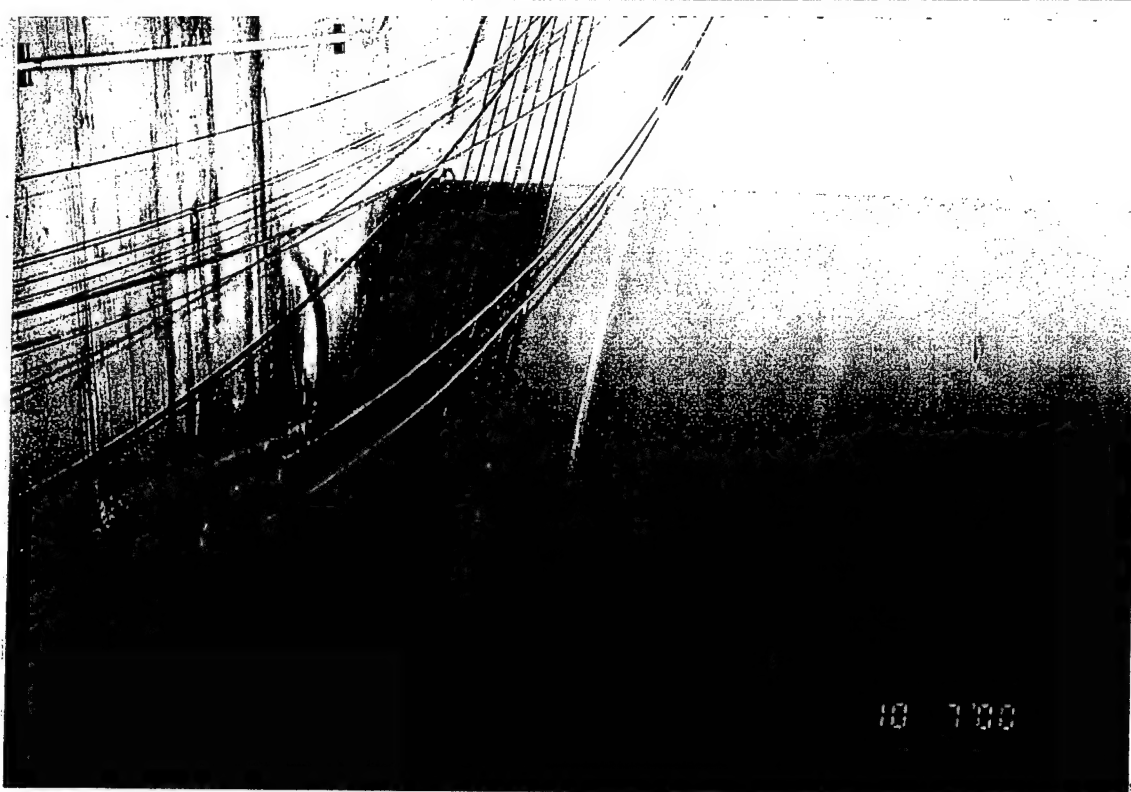
Lower  
Granite  
Dam

10/07/00

1-12

Gate 1

Exposed portion of upstream gate  
face. Note: Surface collector  
installed at this time.



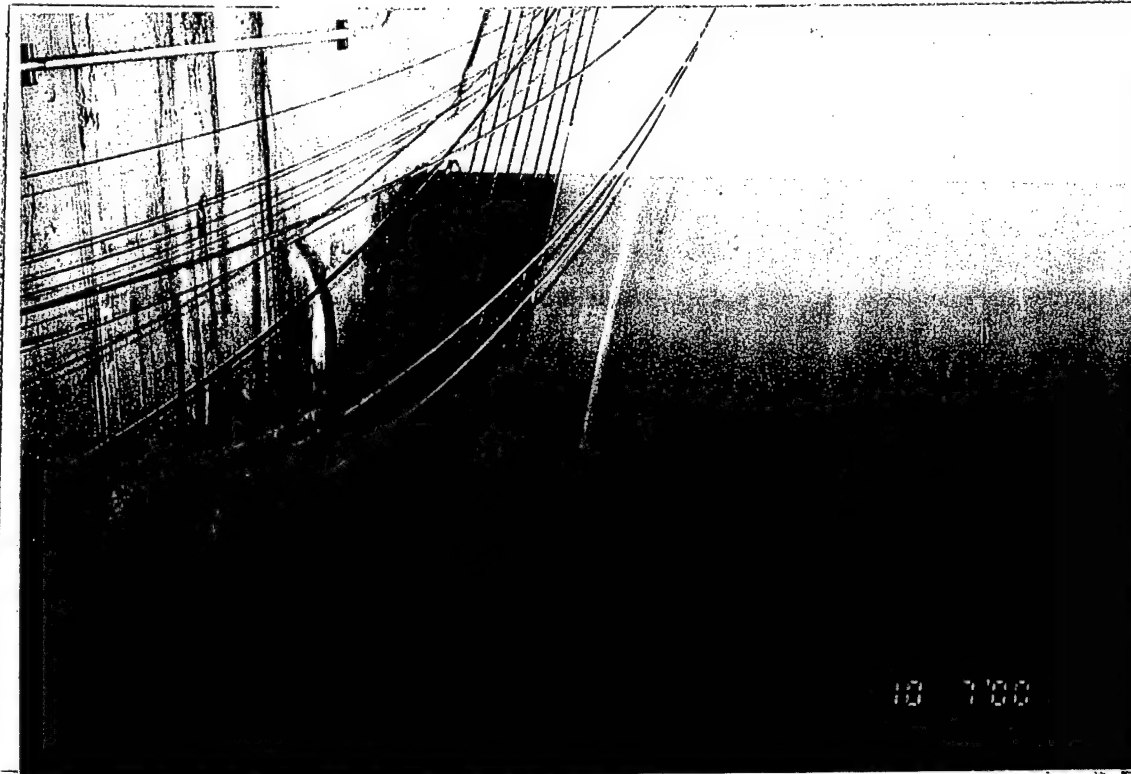
Lower  
Granite  
Dam

10/07/00

1-13

**Gate 1**

Exposed portion of upstream gate  
face. Note: Surface collector  
installed at this time.



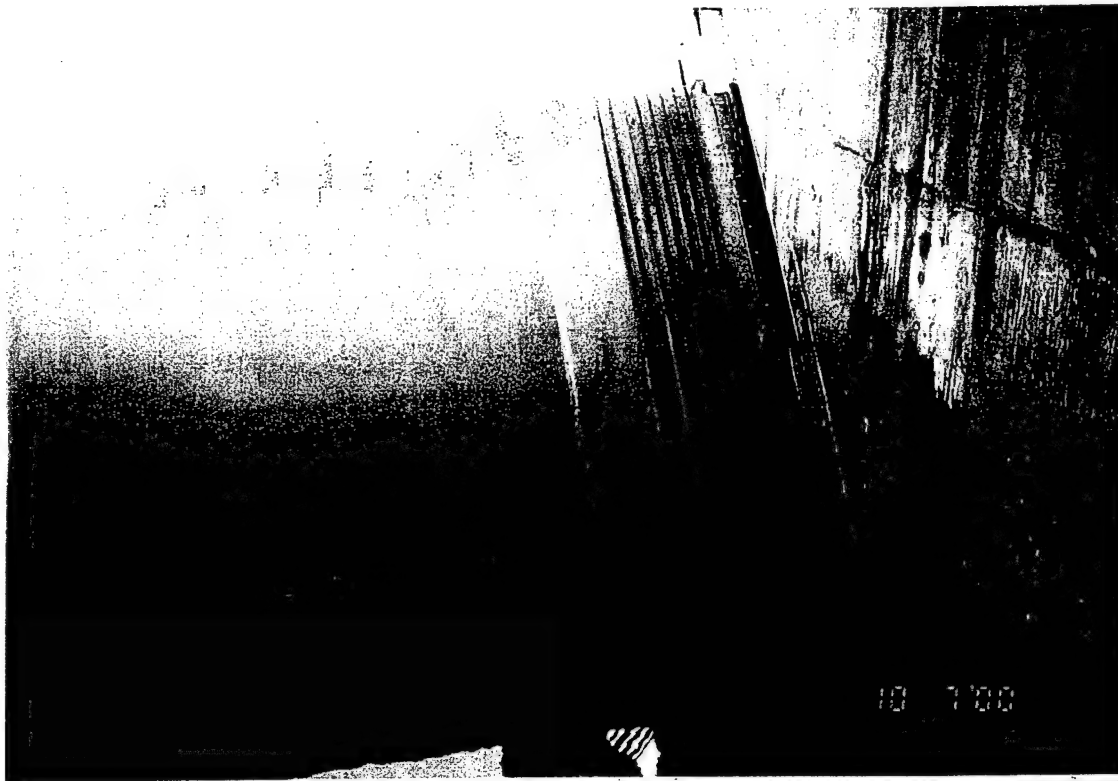
Lower  
Granite  
Dam

10/07/00

1-14

**Gate 1**

Exposed portion of upstream gate  
face. Note: Surface collector  
installed at this time.



Lower  
Granite  
Dam

10/07/00

1-15

#### Gate 1

Exposed portion of upstream gate face. Note: Surface collector installed at this time.



Lower  
Granite  
Dam

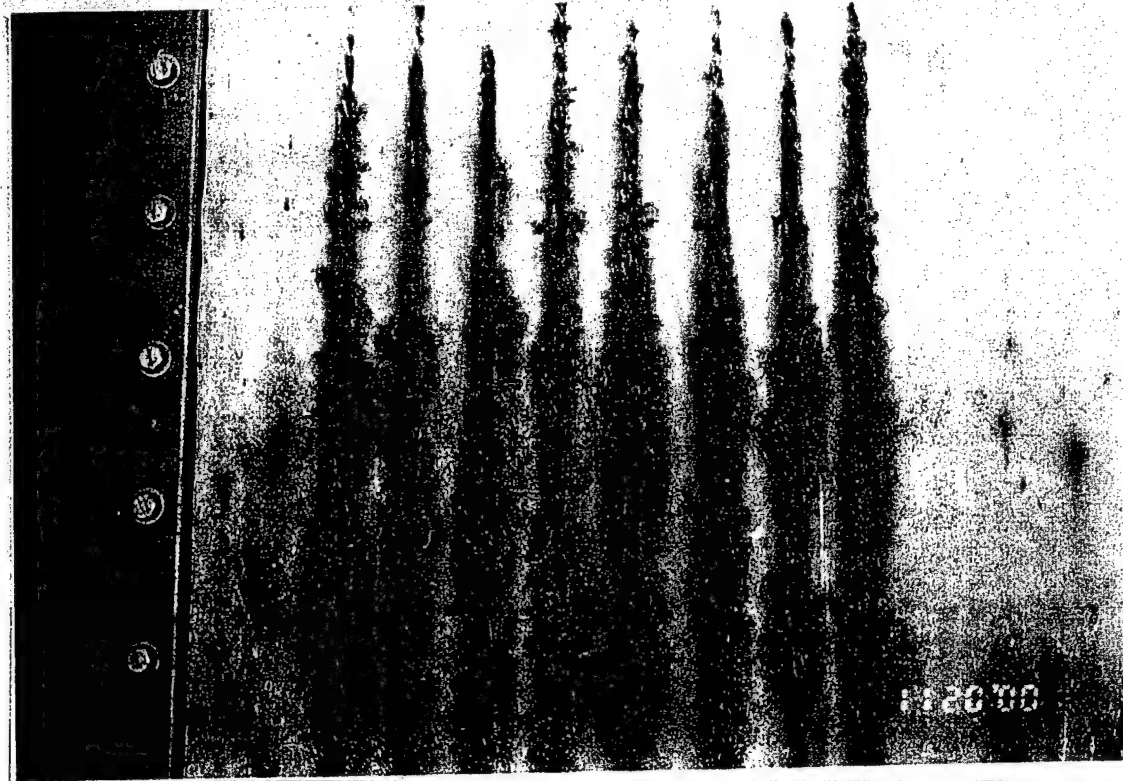
11/20/00

1-16

#### Gate 1

Typical skin plate condition. Light pitting near normal water surface. Note: Surface collector removed.





Lower  
Granite  
Dam

11/20/00

1-17

#### Gate 1

Typical wear plate condition. Light grooves due to cable wear, light to moderate corrosion.

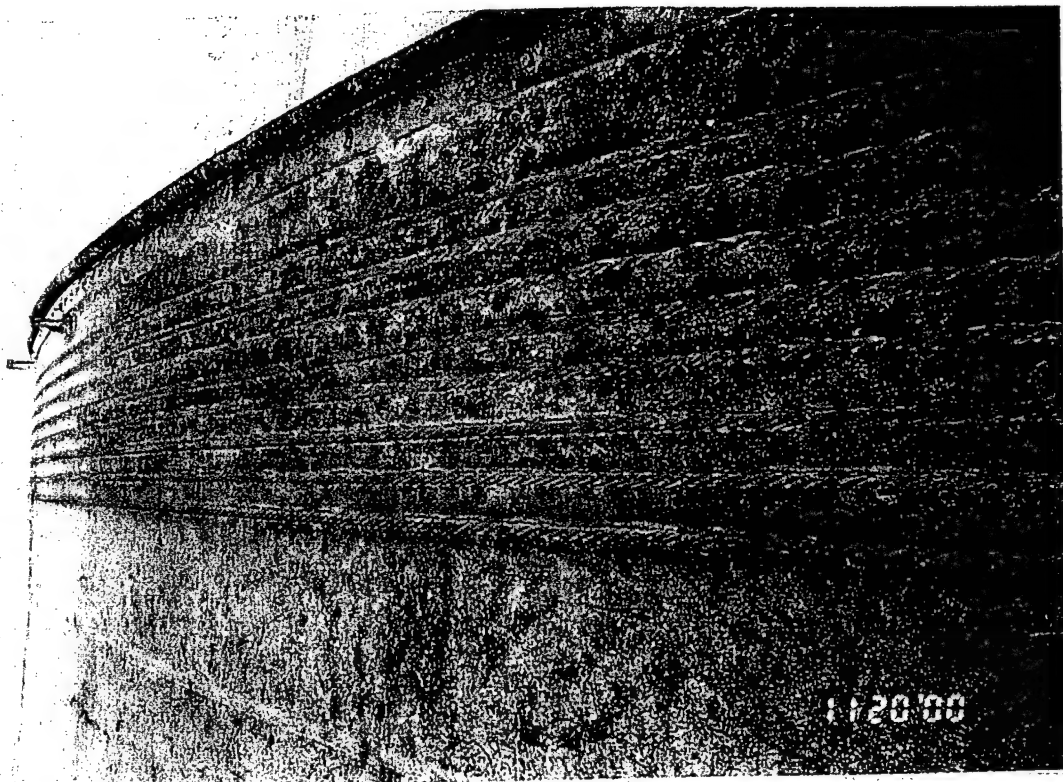


Lower  
Granite  
Dam

11/20/00

#### Gate 1

Typical skin plate condition. Light pitting near normal water surface.  
Note: Surface collector removed.



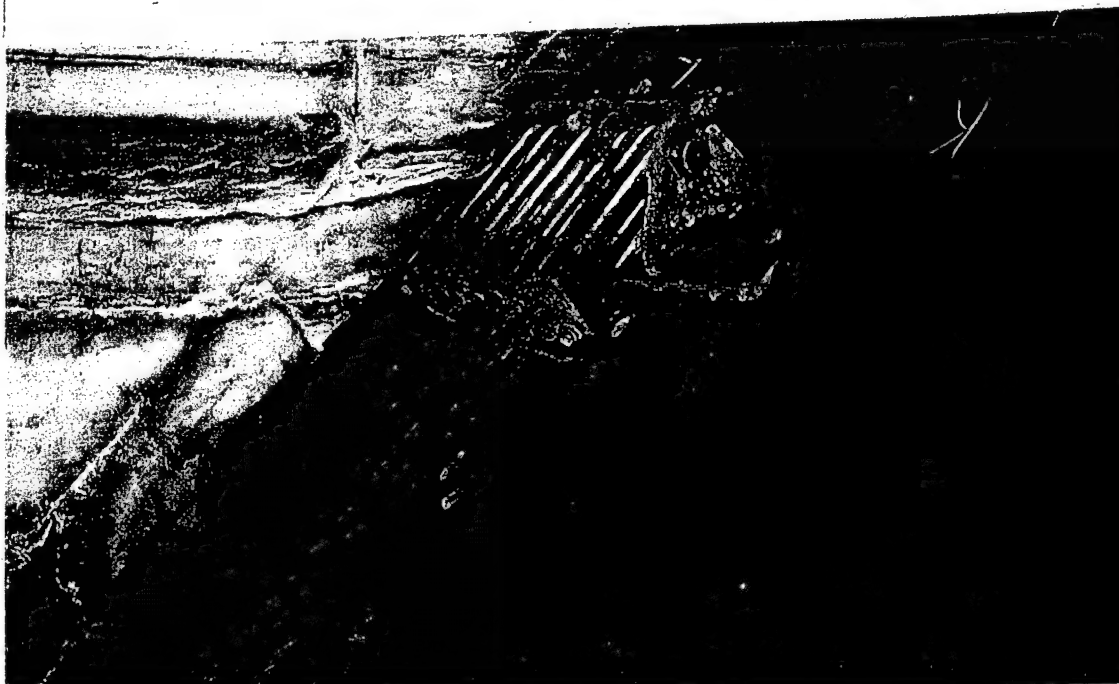
Lower  
Granite  
Dam

11/20/00

1-19

#### Gate 1

Typical wear plate condition. Light grooves due to cable wear, light to moderate corrosion.



Lower  
Granite  
Dam

11/20/00

1-20

#### Gate 1

Right side hoist connection. Light corrosion on lifting lugs and plates.





Lower  
Granite  
Dam

11/20/00

1-21

#### Gate 1

Right side hoist connection. Light corrosion on lifting lugs and plates.  
Note: excellent condition of stainless steel U-bolts.



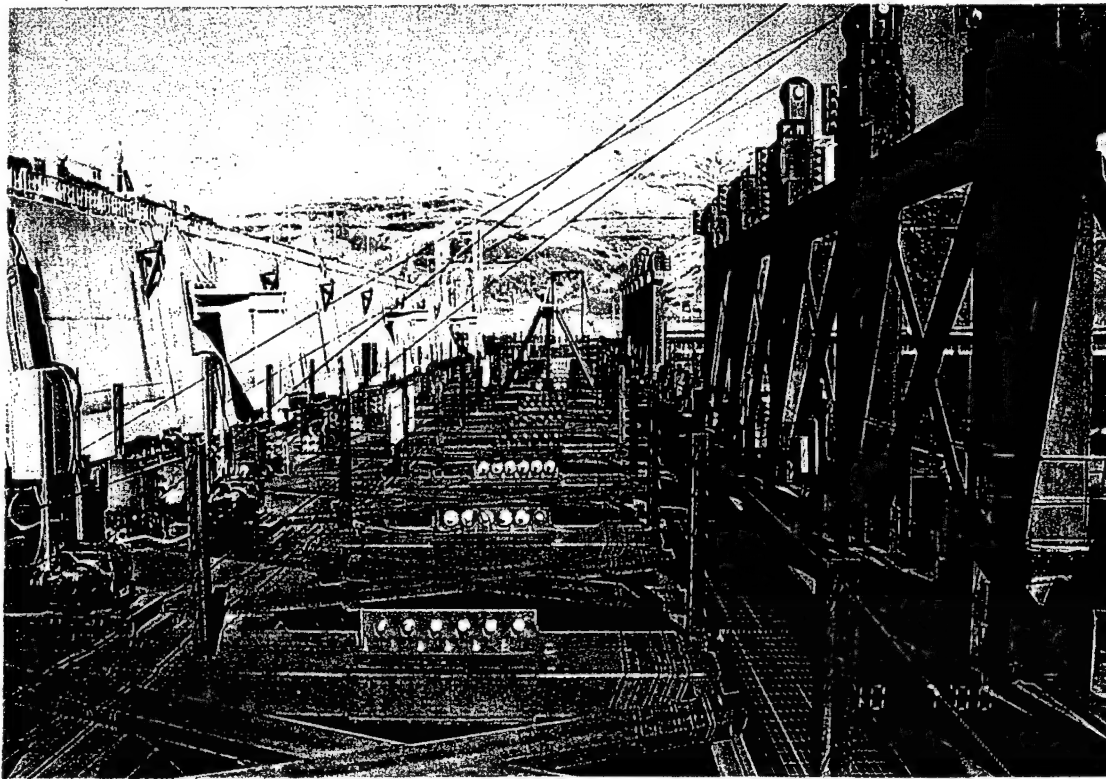
Lower  
Granite  
Dam

11/20/00

1-22

#### Gate 1

Left side hoist connection. Light corrosion on lifting lugs and plates.  
Note: excellent condition of stainless steel U-bolts.

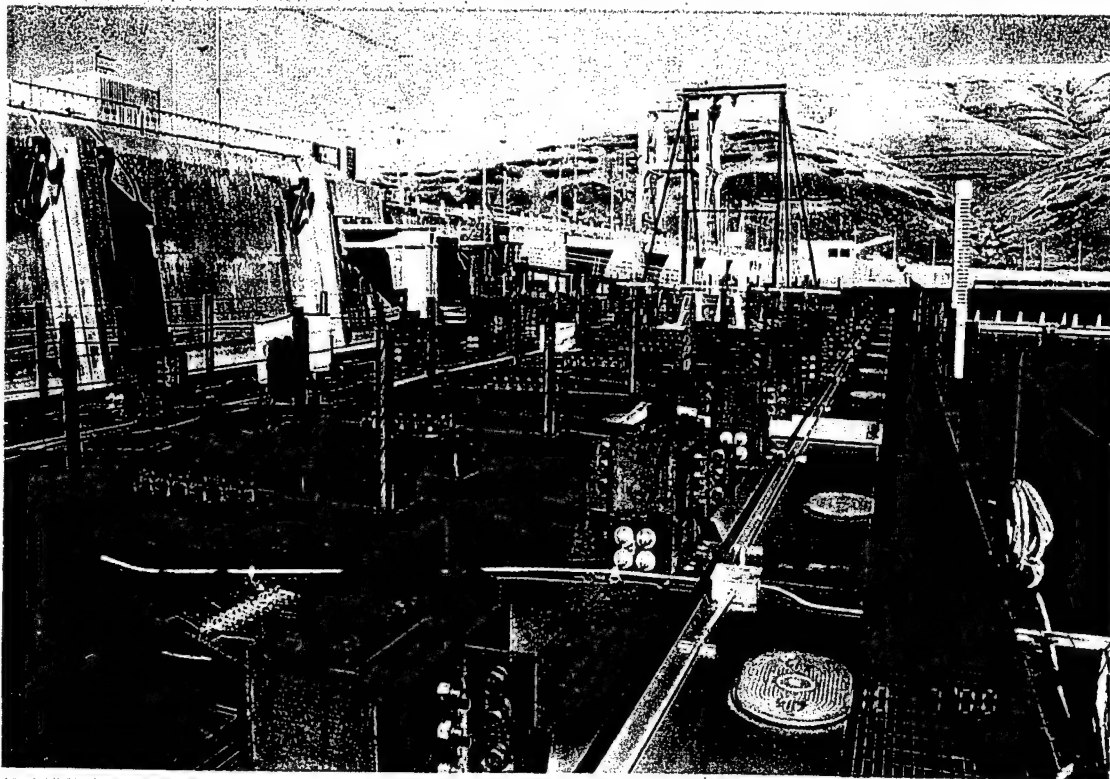


Lower  
Granite  
Dam

Gate 1  
Surface collector installed at Gate 1.

10/07/00

1-23

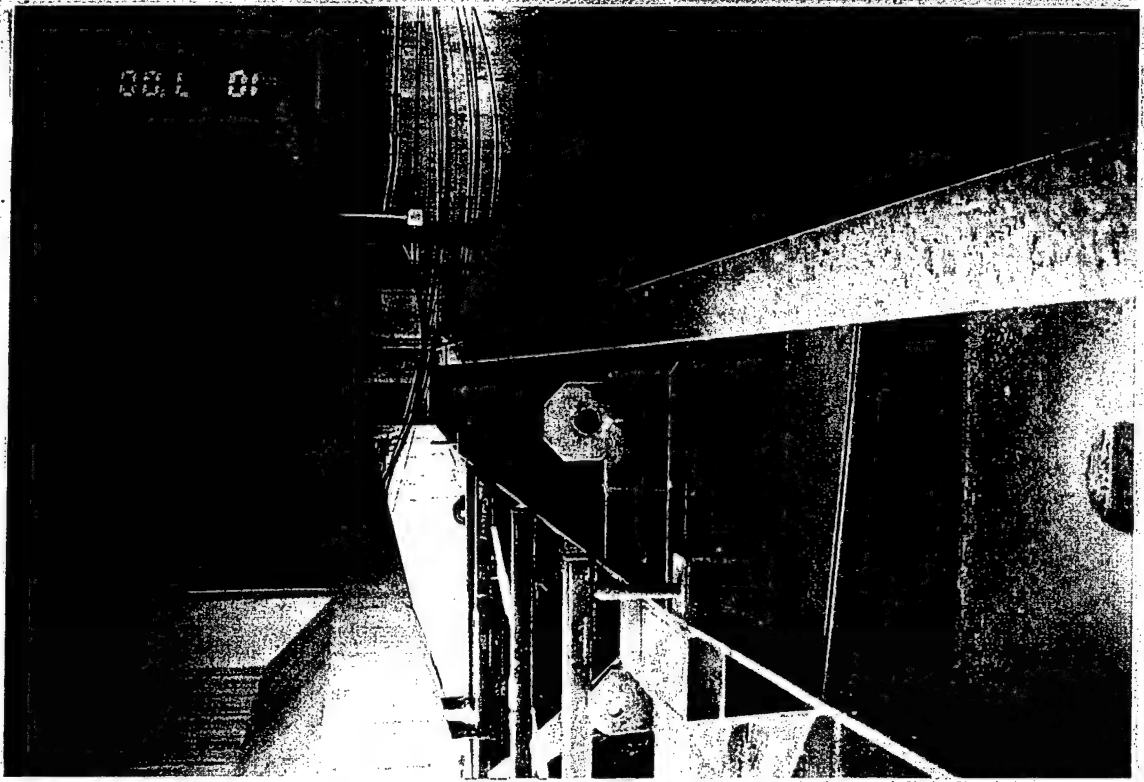


Lower  
Granite  
Dam

Gate 1  
Surface collector installed at Gate 1.

10/07/00

1-24



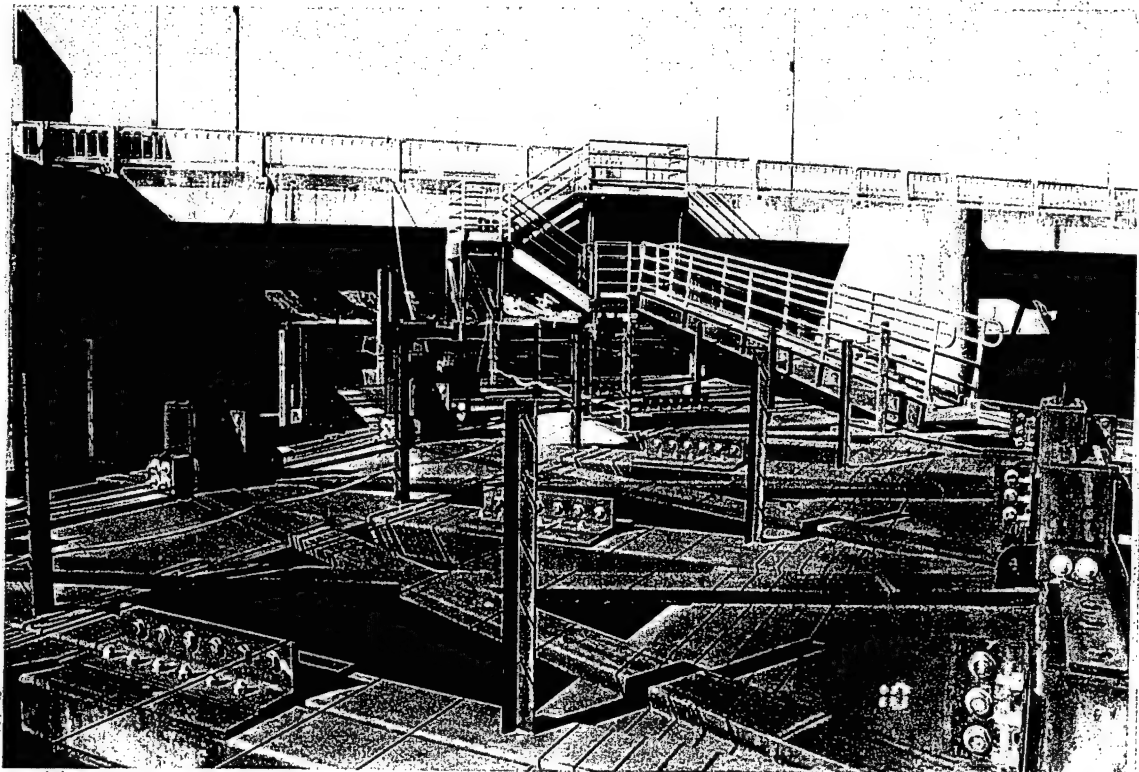
Lower  
Granite  
Dam

#### Gate 1

Gate 1 top stop log with surface  
collector attached to upstream side.

10/07/00

1-25



Lower  
Granite  
Dam

#### Gate 1

Surface collector installed at Gate 1.

10/07/00

1-26



Lower  
Granite  
Dam

10/05/00

2-1

**Gate 2**

Left end, middle horizontal girder.  
Peeling paint on purlins, light  
corrosion.



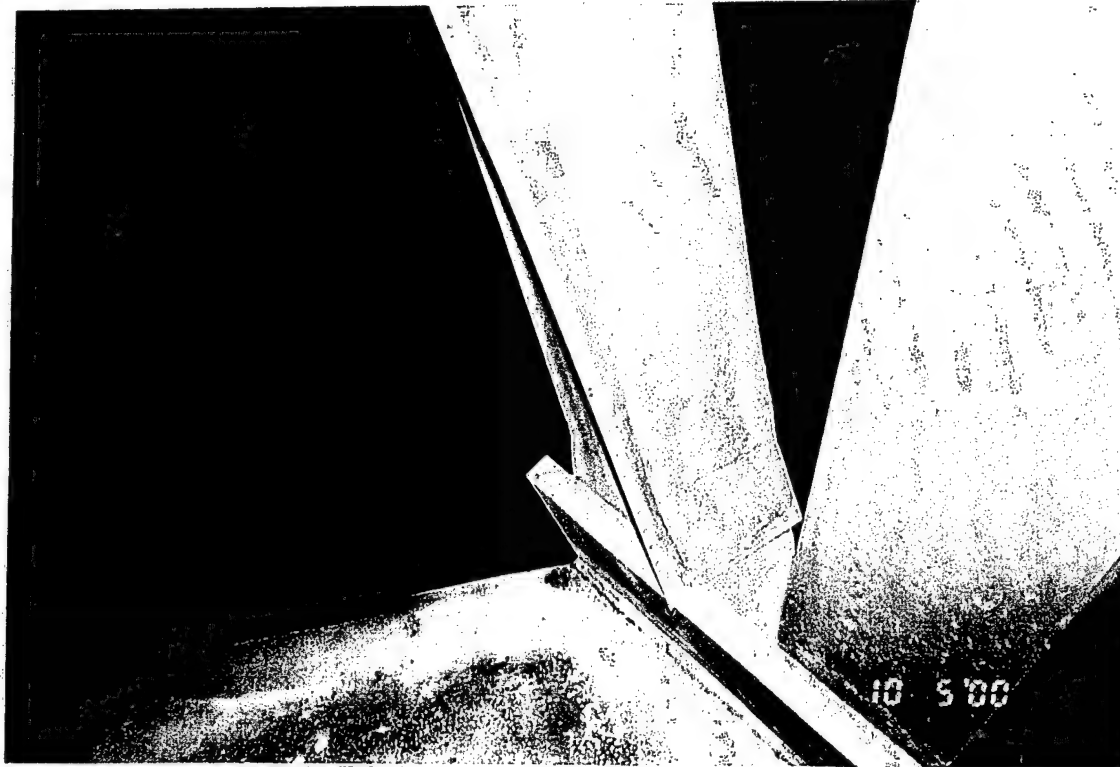
Lower  
Granite  
Dam

10/05/00

2-2

**Gate 2**

Left end, middle horizontal girder.  
Peeling paint on purlins, light  
corrosion.



Lower  
Granite  
Dam

10/05/00

2-3

**Gate 2**

Left frame, vertical Brace A at middle  
horizontal girder. Approx. 3/4"  
deformation in ST



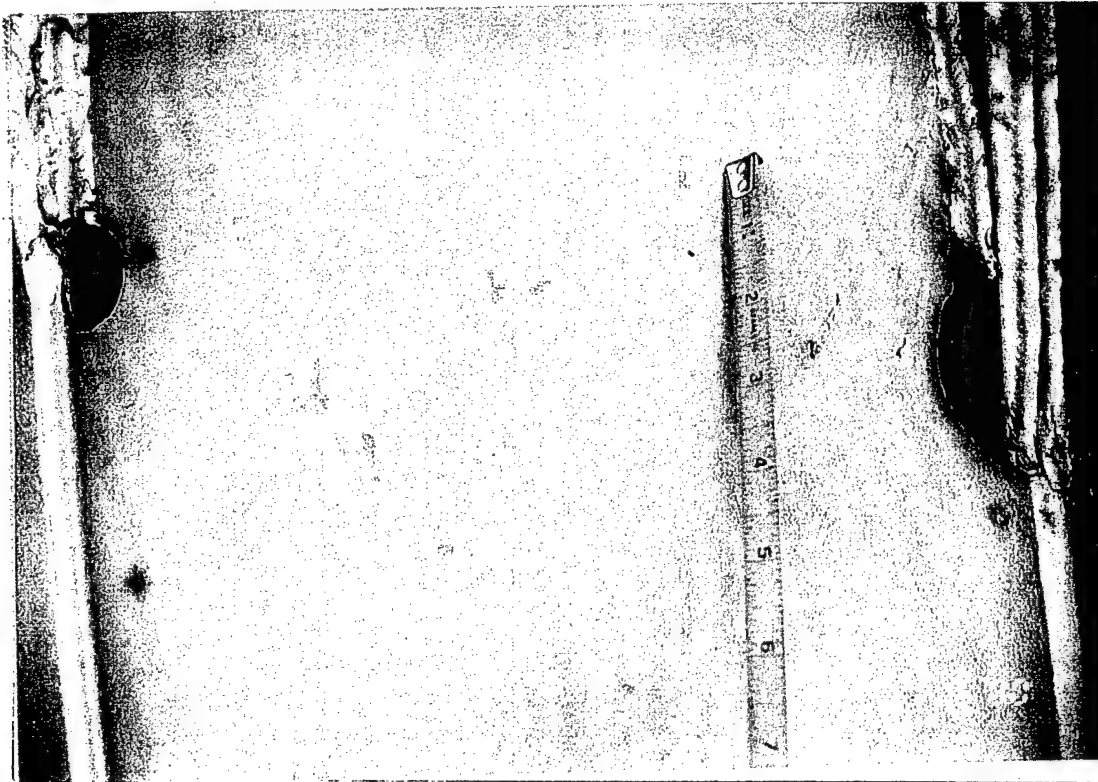
Lower  
Granite  
Dam

10/05/00

2-4

**Gate 2**

Left frame, vertical Brace A and K at  
middle horizontal girder.  
Misalignment in vertical braces due to  
1" deformation in Brace A.

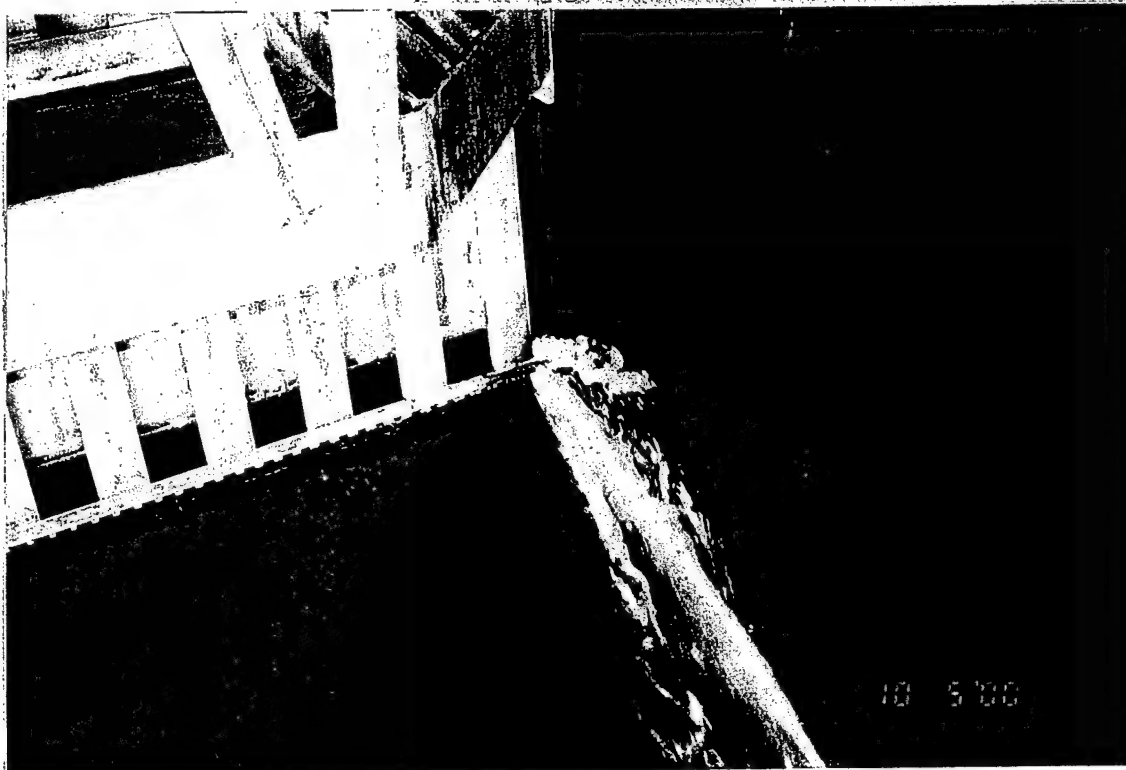


Lower  
Granite  
Dam

**Gate 2**  
Left frame, Brace H. Copping in brace  
at weld to top radial strut. Light  
corrosion at isolated spots.

10/05/00

2-5



Lower  
Granite  
Dam

**Gate 2**  
Bottom / side seal leak at bottom left  
corner of gate.

10/05/00

2-6





Lower  
Granite  
Dam

10/05/00

2-7

Gate 2

Leak at center construction joint in  
spillway monolith.



Lower  
Granite  
Dam

10/05/00

2-8

Gate 2

Left end of bottom horizontal girder.  
Standing water, no drainage between  
multiple stiffeners.





Lower  
Granite  
Dam

10/05/00

2-9

#### Gate 2

Left end of bottom horizontal girder.  
Standing water, no drainage between  
multiple stiffeners. Horizontal girder  
to skin plate stiffeners, standing  
water, debris and no drainage



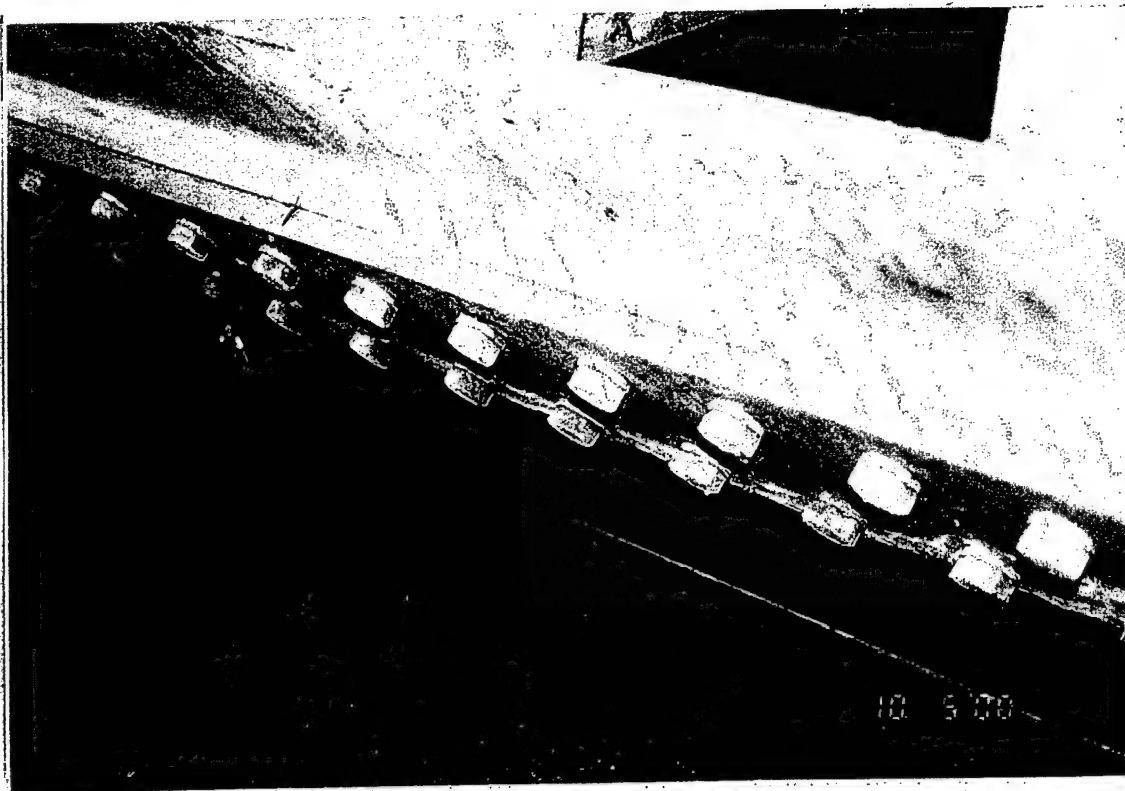
Lower  
Granite  
Dam

10/05/00

2-10

#### Gate 2

Bottom seal closure plate looking  
upstream. Standing water between  
closure plate, purlin webs and  
skinplate. Typical. Leak at center  
const. joint in spillway monolith.



Lower  
Granite  
Dam

**Gate 2**

Bottom seal keeper bar and closure  
plate, typical.

10/05/00

2-11



Lower  
Granite  
Dam

**Gate 2**

Bottom seal closure plate looking  
upstream. Standing water between  
closure plate, purlin webs and  
skinplate. Typical.

10/05/00

2-12



Lower  
Granite  
Dam

10/05/00

2-13

**Gate 2**

Close-up, right end of bottom  
horizontal girder. Standing water, no  
drainage between multiple stiffeners.



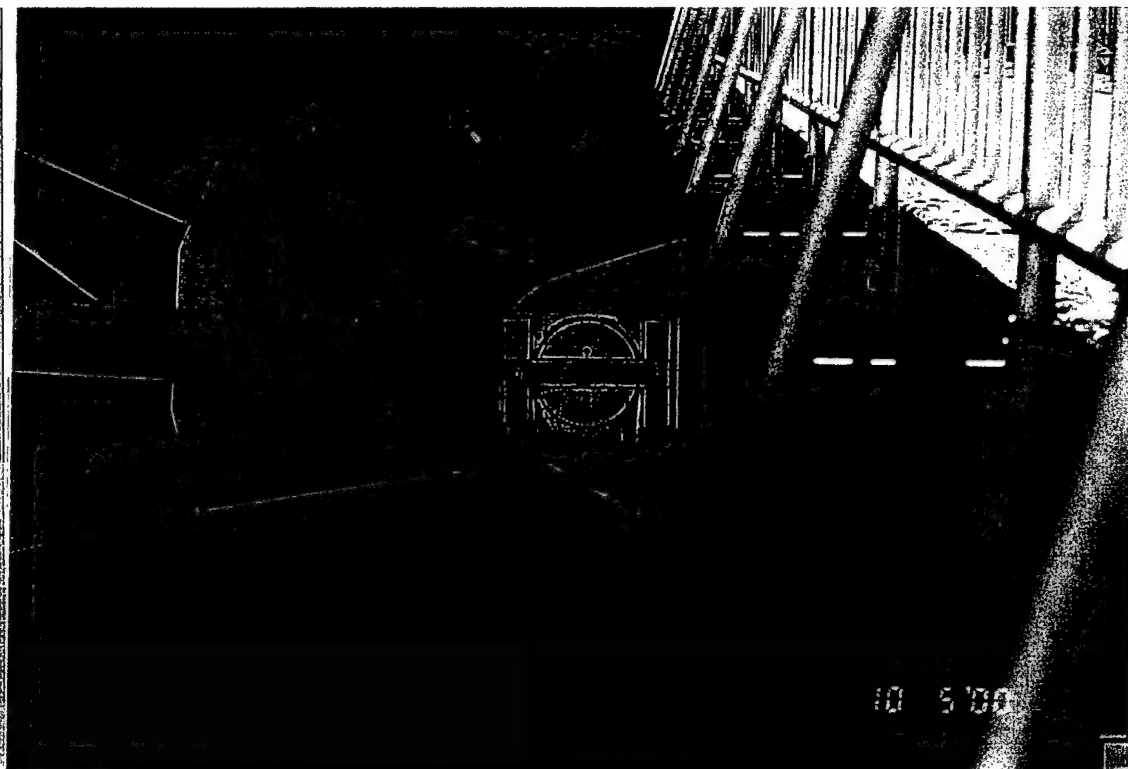
Lower  
Granite  
Dam

10/05/00

2-14

**Gate 2**

Right end of bottom horiz. girder.  
Standing water, no drainage between  
multiple stiffeners. Horizontal girder  
to skin plate stiffeners, standing  
water, debris and no drainage



Lower  
Granite  
Dam

Gate 2  
Left trunnion, typical.

10/05/00

2-15



Lower  
Granite  
Dam

Gate 2  
Gate face and side frames, typical

10/05/00

2-16

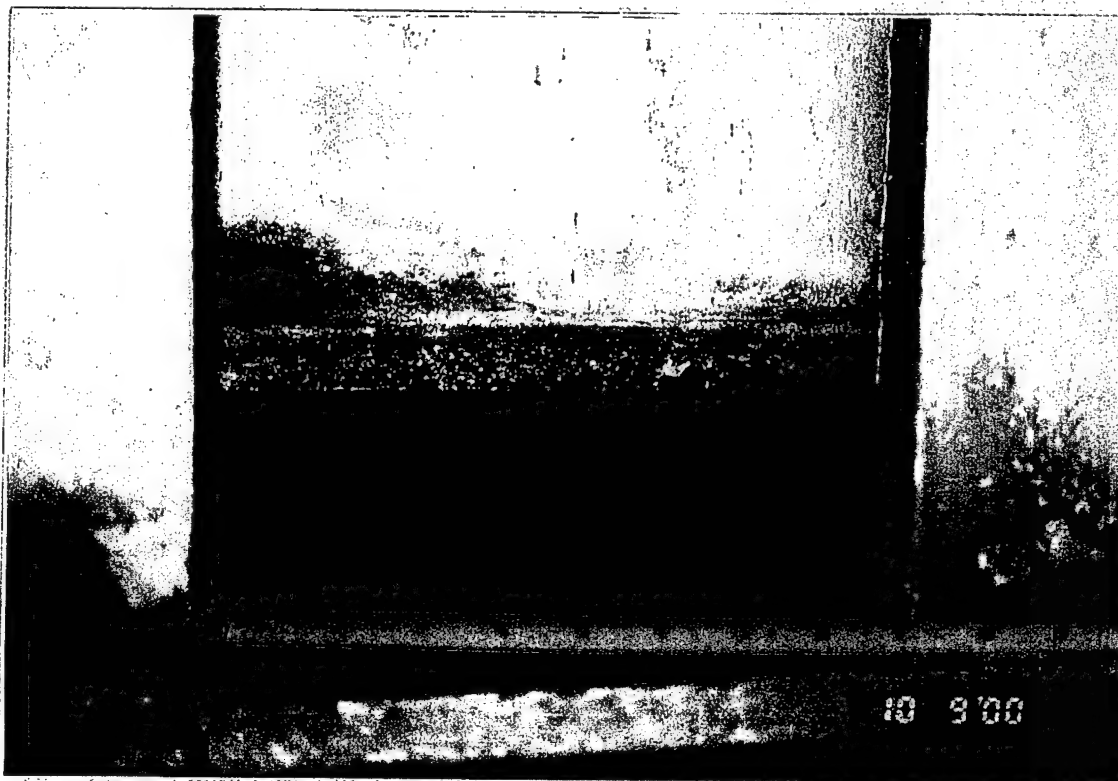


Lower  
Granite  
Dam

Gate 2  
Top of right trunnion, typical.

10/05/00

2-17



Lower  
Granite  
Dam

Gate 2  
Bottom seal closure plate looking  
upstream. Standing water between  
closure plate, purlin webs and  
skinplate. Typical.

10/09/00

2-18



Lower  
Granite  
Dam

10/09/00

2-19

#### Gate 2

Bottom seal closure plate looking  
upstream. Standing water between  
closure plate, purlin webs and  
skinplate. Typical.



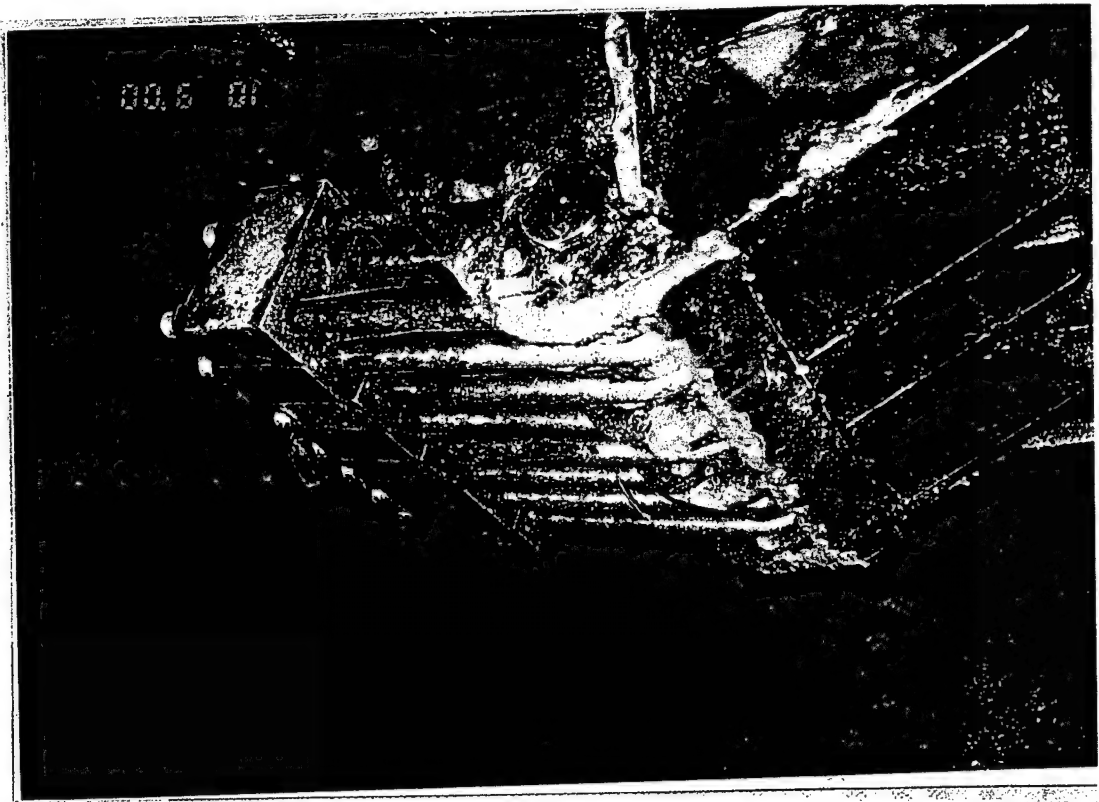
Lower  
Granite  
Dam

10/09/00

#### Gate 2

Bottom seal closure plate looking  
upstream. Standing water between  
closure plate, purlin webs and  
skinplate. Typical.





Lower  
Granite  
Dam

10/09/00

2-21

#### Gate 2

Left side hoist connection. Light corrosion on lifting lugs and plates.

Note: Excellent condition of stainless steel U-bolts.



Lower  
Granite  
Dam

10/09/00

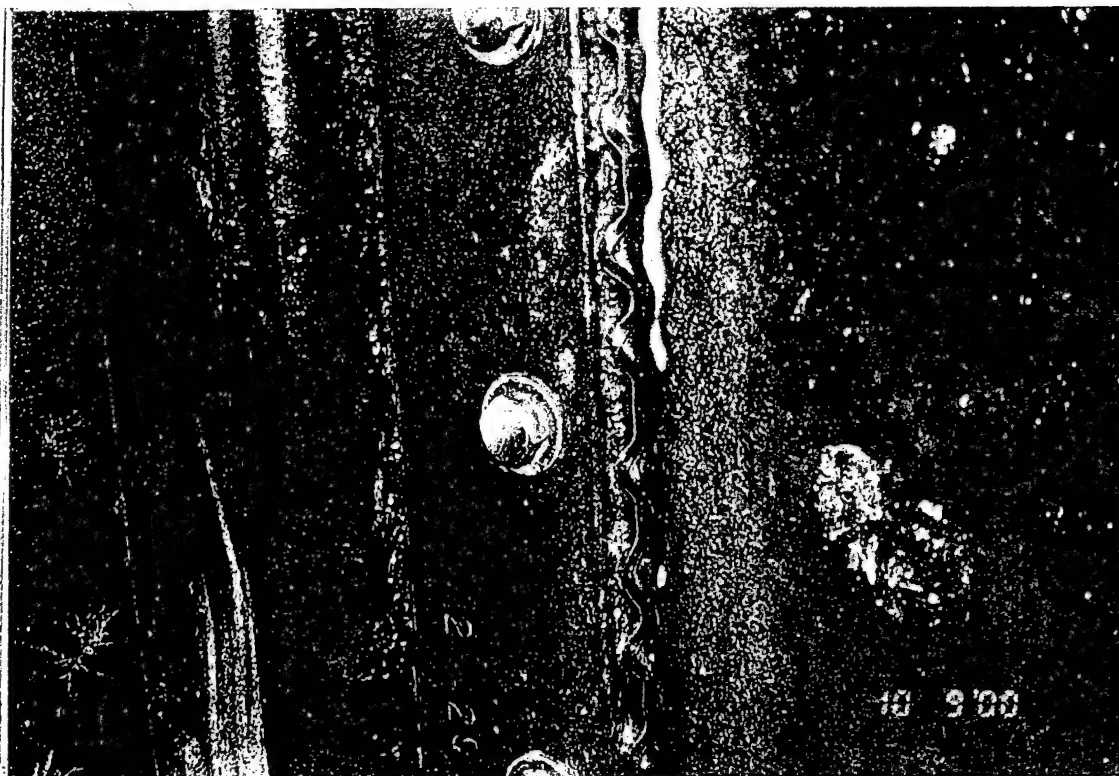
2-22

#### Gate 2

Left side hoist connection. Light corrosion on lifting lugs and plates.

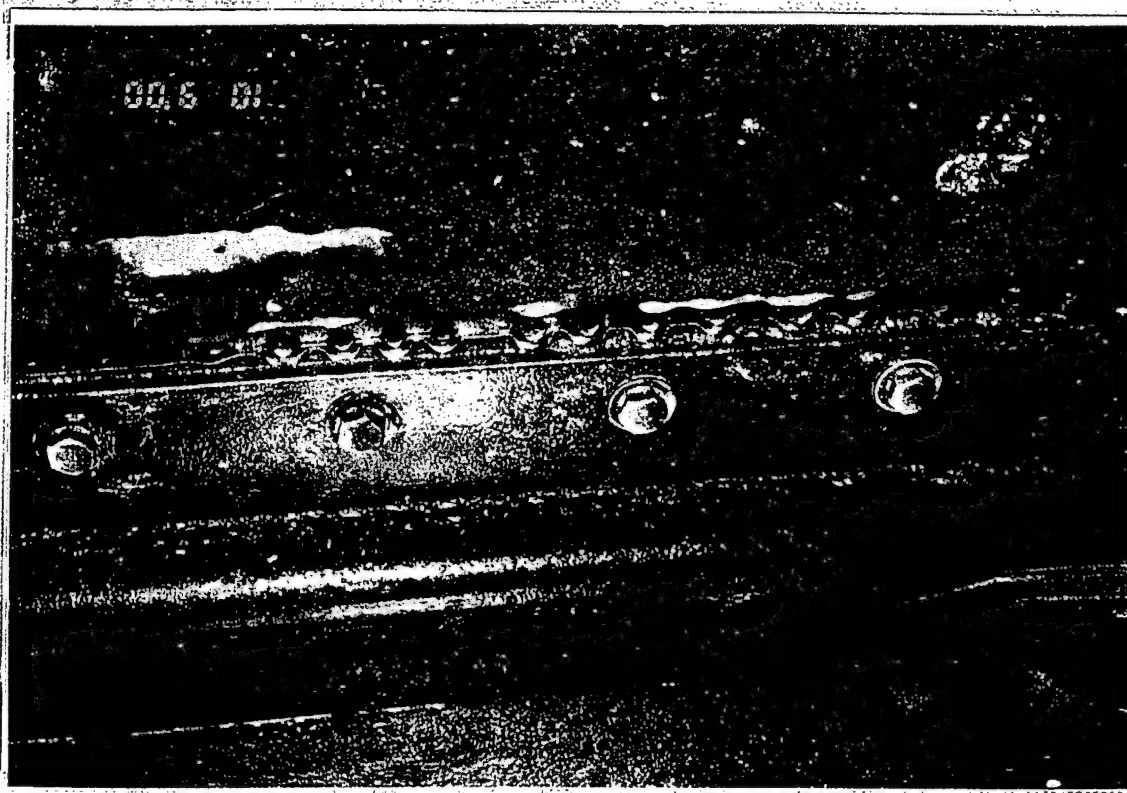
Note: Excellent condition of stainless steel U-bolts.





Lower  
Granite  
Dam  
  
10/09/00  
  
2-23

**Gate 2**  
Upstream side of left side seal. Light corrosion and pitting on skin plate.



Lower  
Granite  
Dam  
  
10/05/00  
  
2-24

**Gate 2**  
Upstream side of left side seal. Light corrosion and pitting on skin plate.

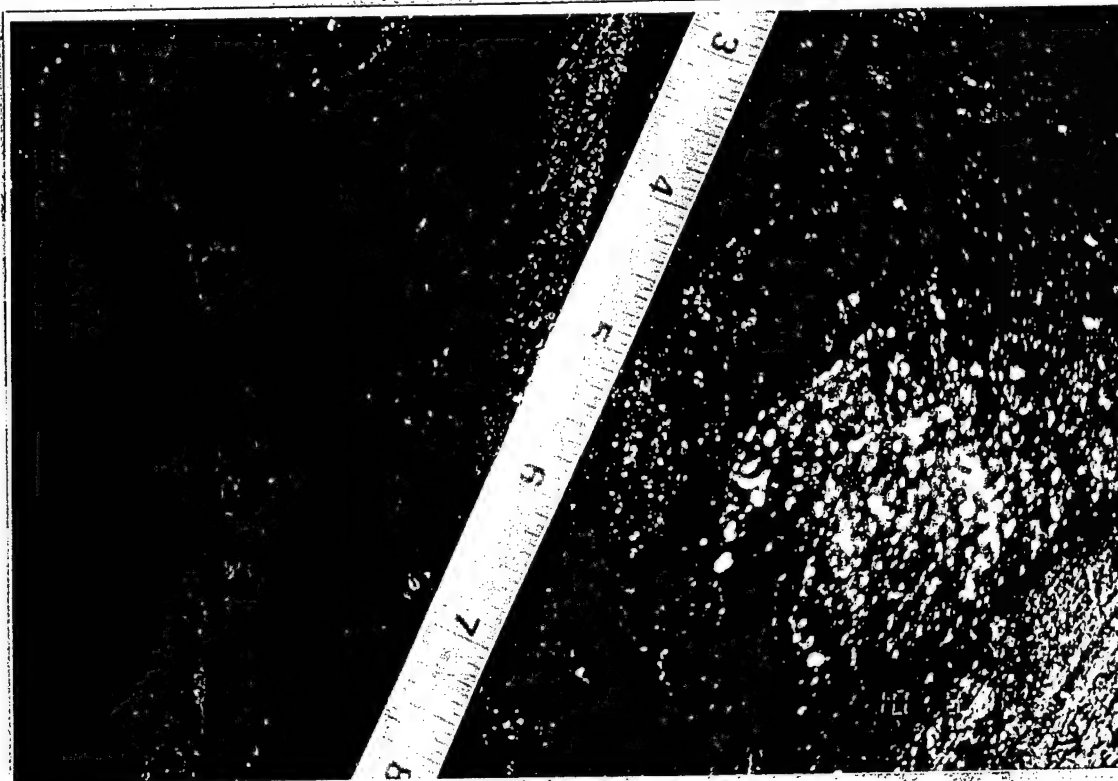


Lower  
Granite  
Dam

Gate 2  
Close-up, skin plate, typical.

10/05/00

2-25

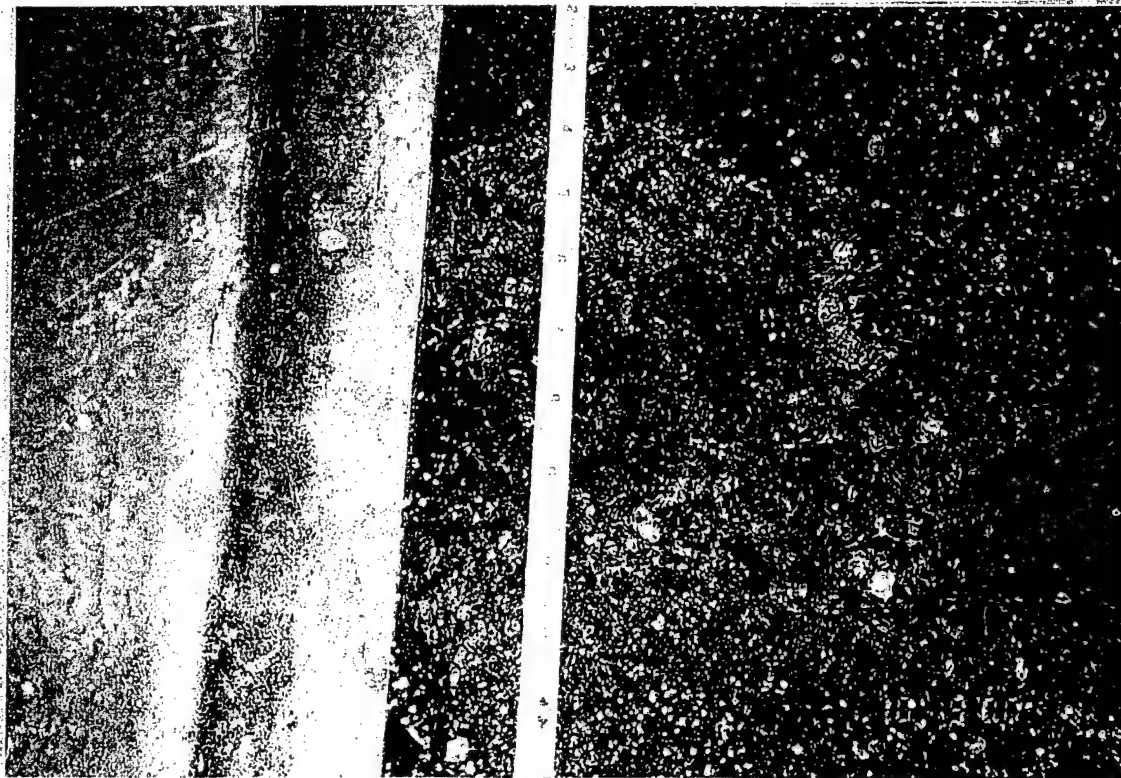


Lower  
Granite  
Dam

Gate 2  
Close-up skin plate, typical.

10/09/00

2-26

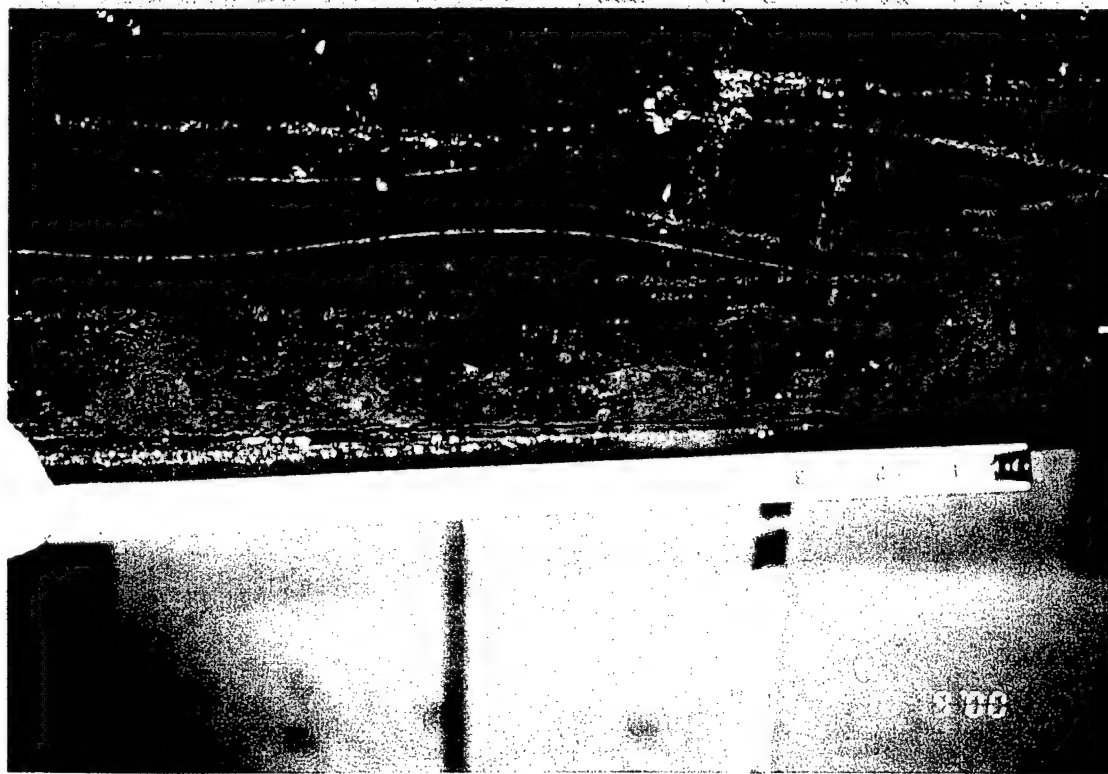


Lower  
Granite  
Dam

Gate 2  
Embedded bottom seal plate, looking  
down at spillway, typical.

10/09/00

2-27



Lower  
Granite  
Dam

Gate 2  
Upstream side of bottom seal and  
bottom of skin plate. Light to  
moderate corrosion on skin plate.

10/09/00

2-28

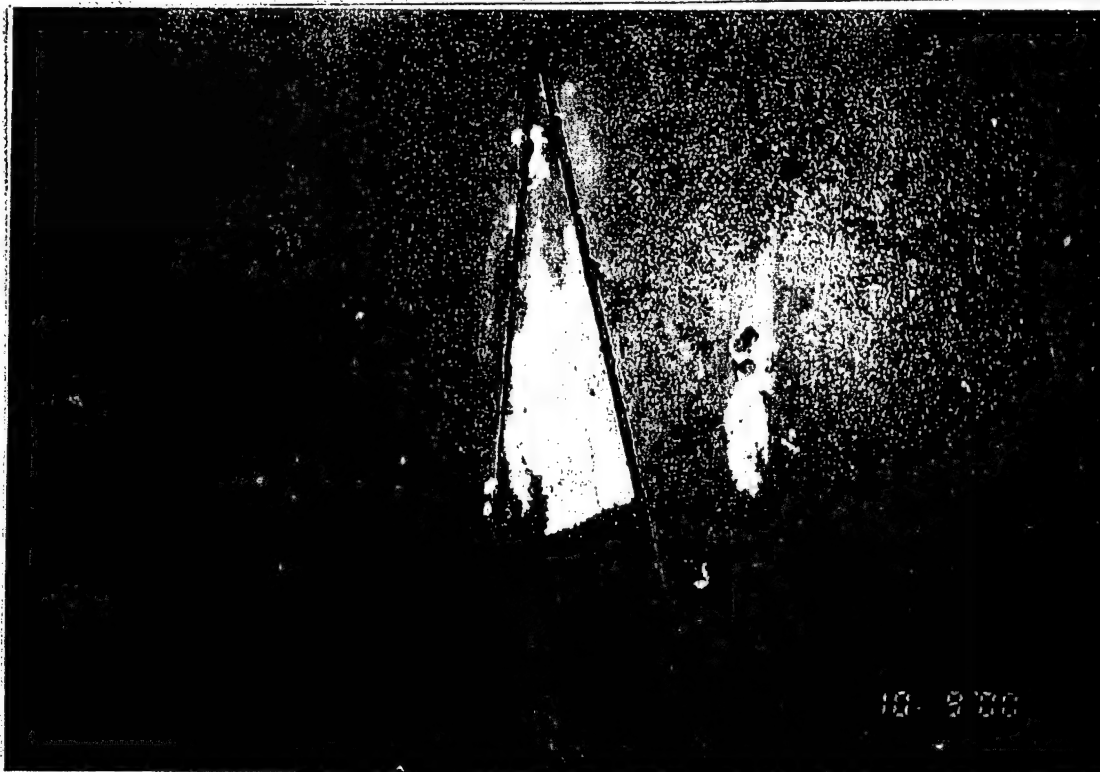


Lower  
Granite  
Dam

**Gate 2**  
Downstream side of bottom seal,  
typical.

10/09/00

2-29

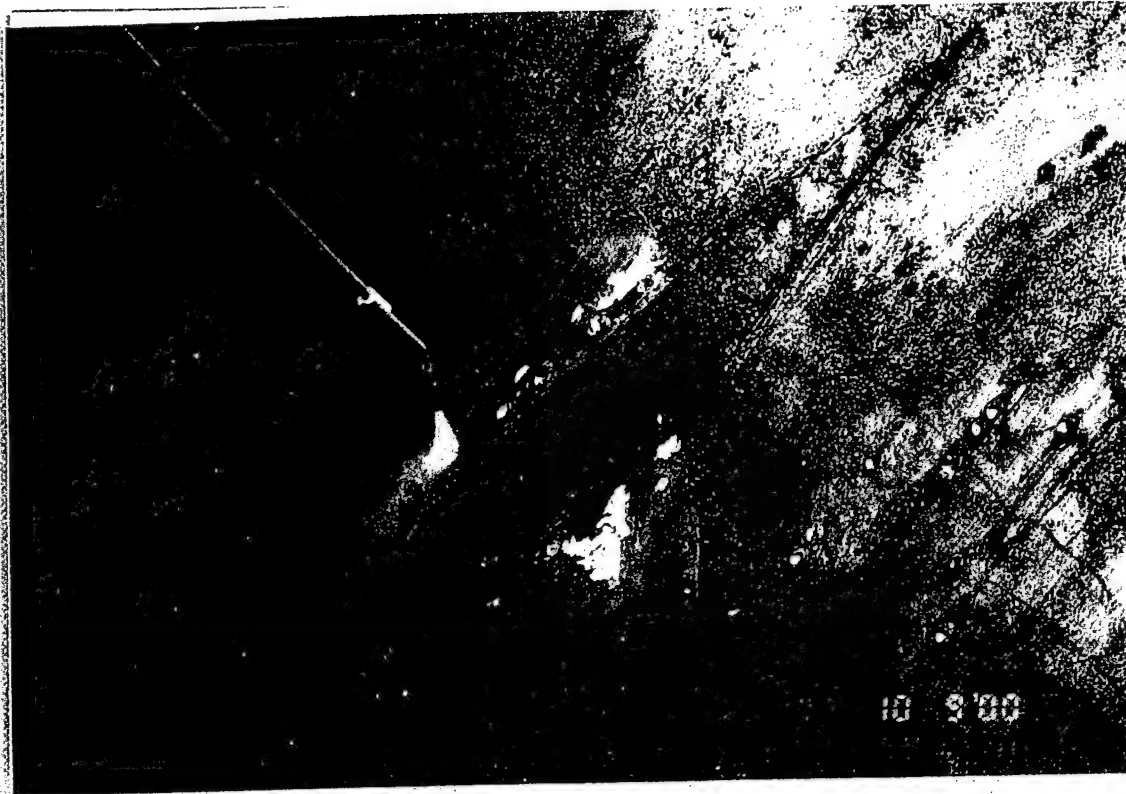


Lower  
Granite  
Dam

**Gate 2**  
Skin plate pitting, typical.

10/09/00

2-30



Lower  
Granite  
Dam

10/09/00

2-31

Gate 2  
Waterblasting of skin plate pitting,  
typical.



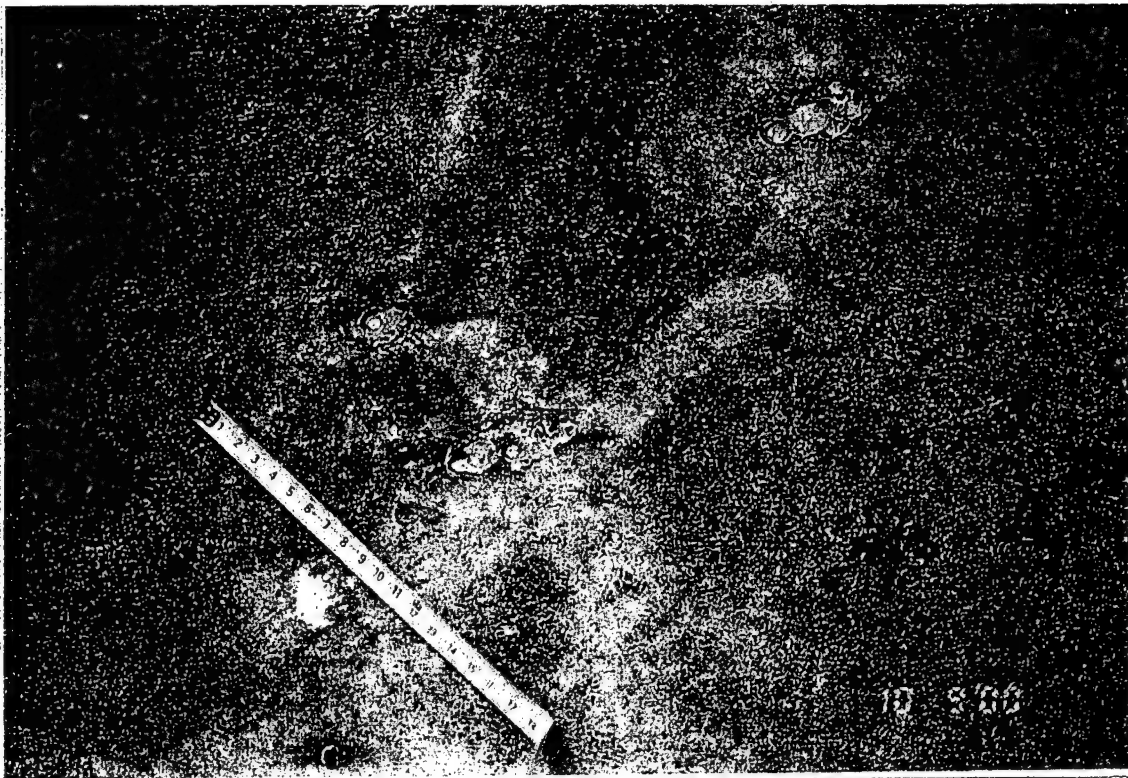
Lower  
Granite  
Dam

10/09/00

2-32

Gate 2  
Typical pitting.





Lower  
Granite  
Dam

10/09/00

2-33

Gate 2  
Typical pitting.

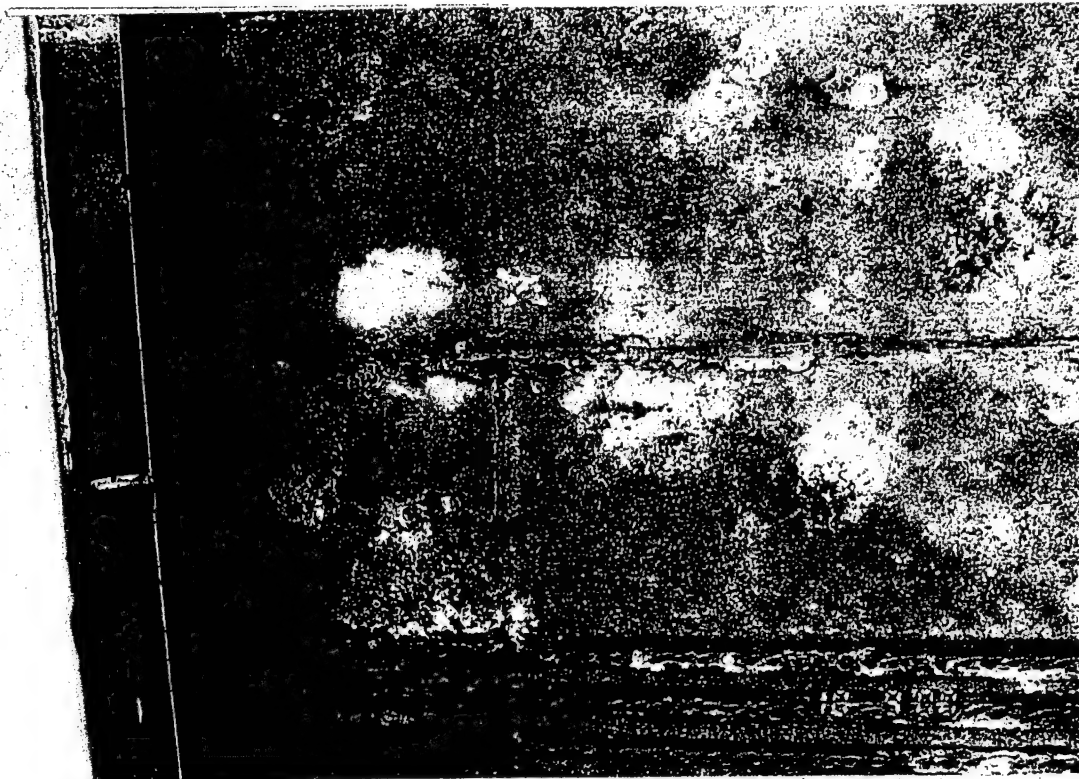


Lower  
Granite  
Dam

10/09/00

2-34

Gate 2  
Typical wear plate condition. Light  
grooves due to cable wear, light to  
moderate corrosion.



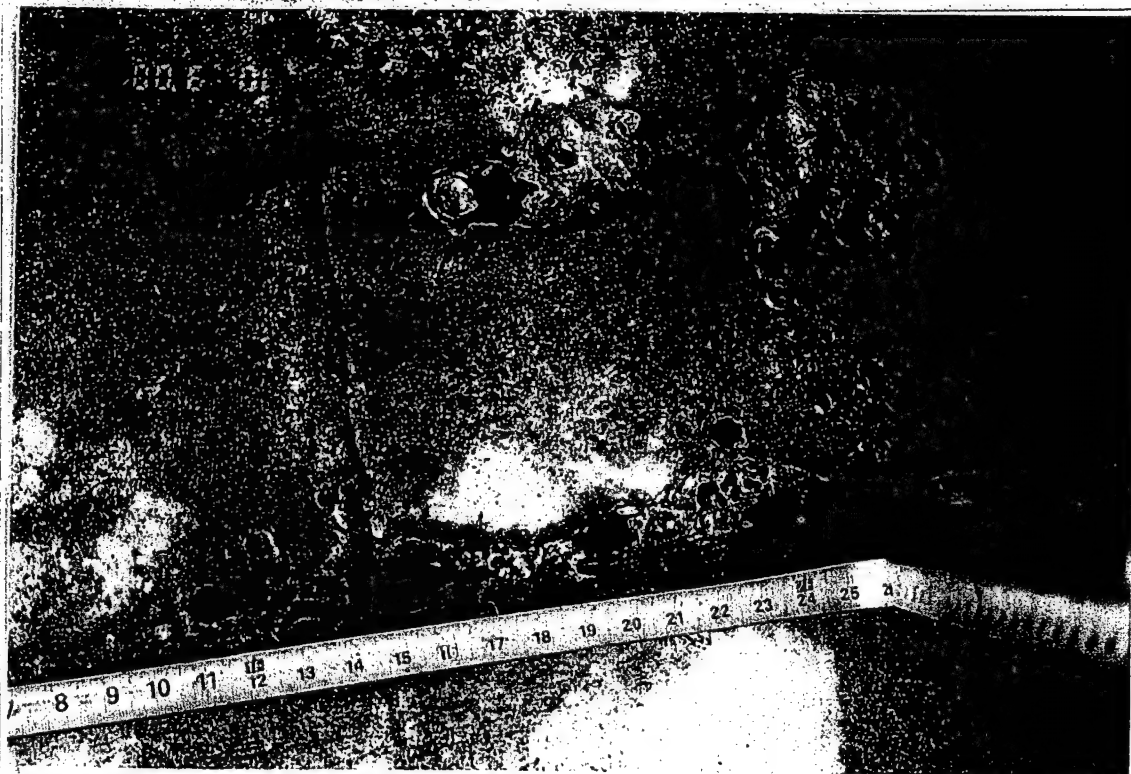
Lower  
Granite  
Dam

10/09/00

2-35

#### Gate 2

Skin plate pitting and corrosion along construction joint weld at left side of gate.



Lower  
Granite  
Dam

10/09/00

2-36

#### Gate 2

Close-up, skin plate pitting and corrosion along construction joint weld at left side of gate





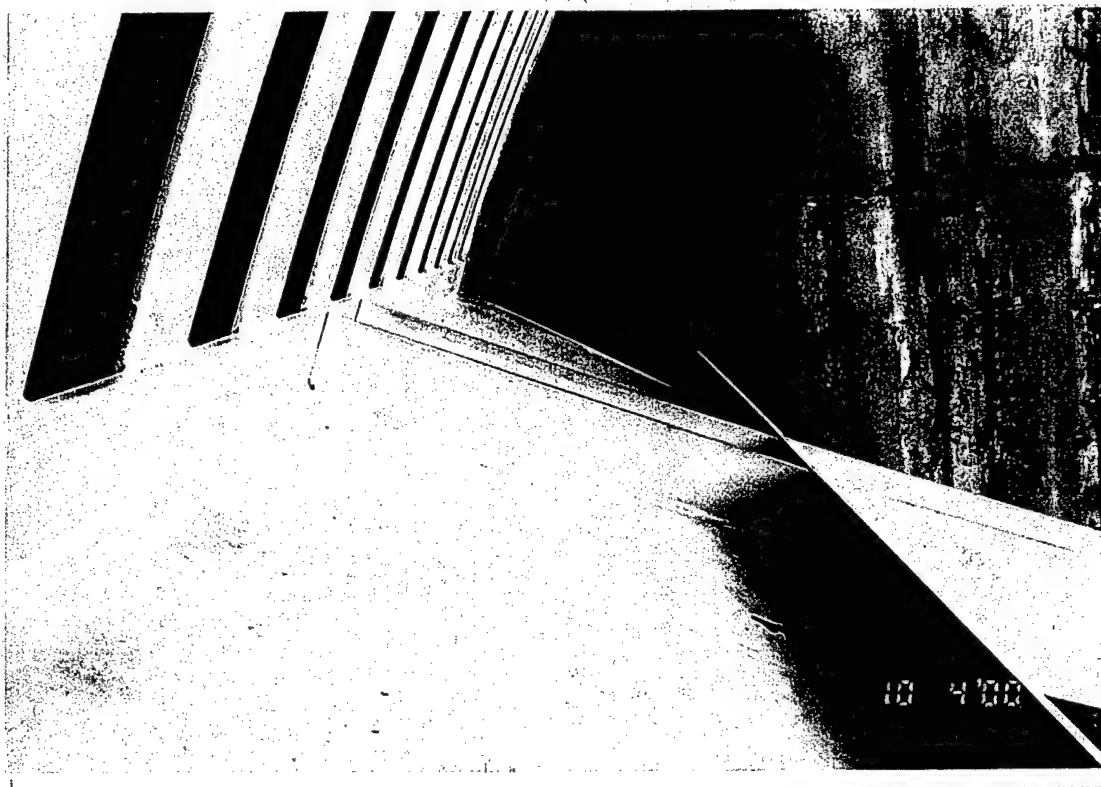
Lower  
Granite  
Dam

10/04/00

3-1

#### Gate 3

Left end of top horizontal girder.  
Chipped paint and light surface  
corrosion.



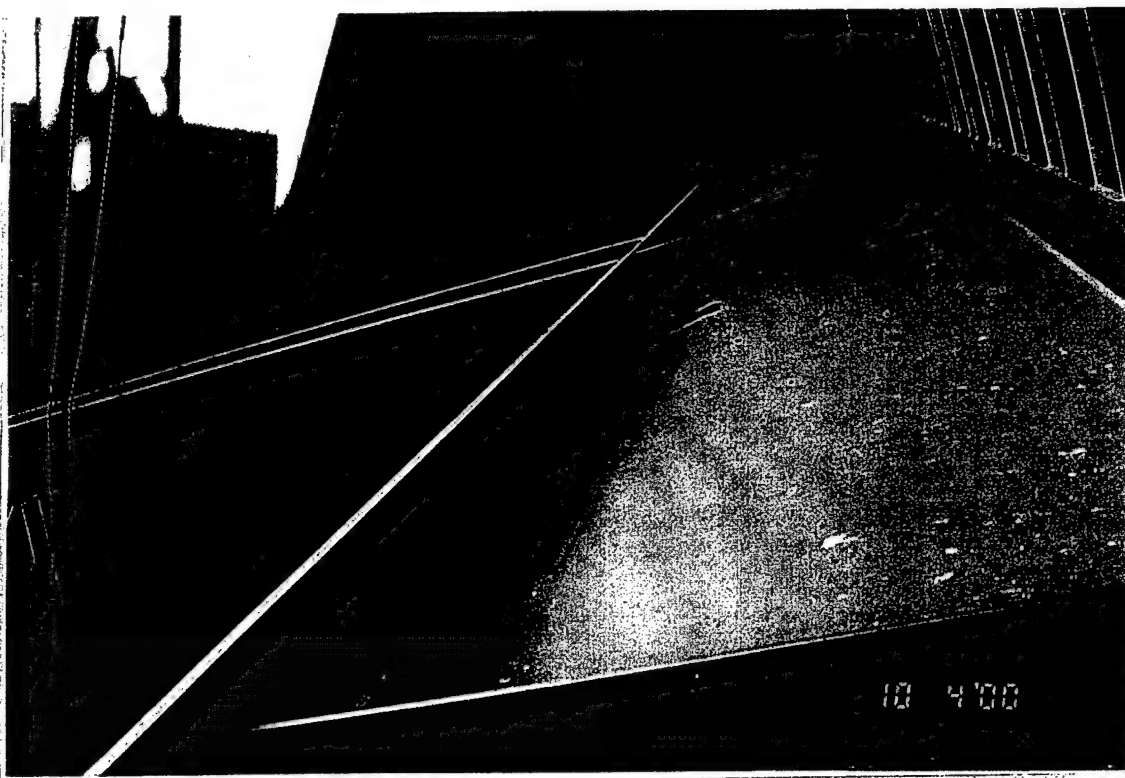
Lower  
Granite  
Dam

10/04/00

3-2

#### Gate 3

Left end of top horizontal girder.  
Chipped paint and light surface  
corrosion. Note: Debris line on  
downstream flange of girder  
indicating inadequate drainage.

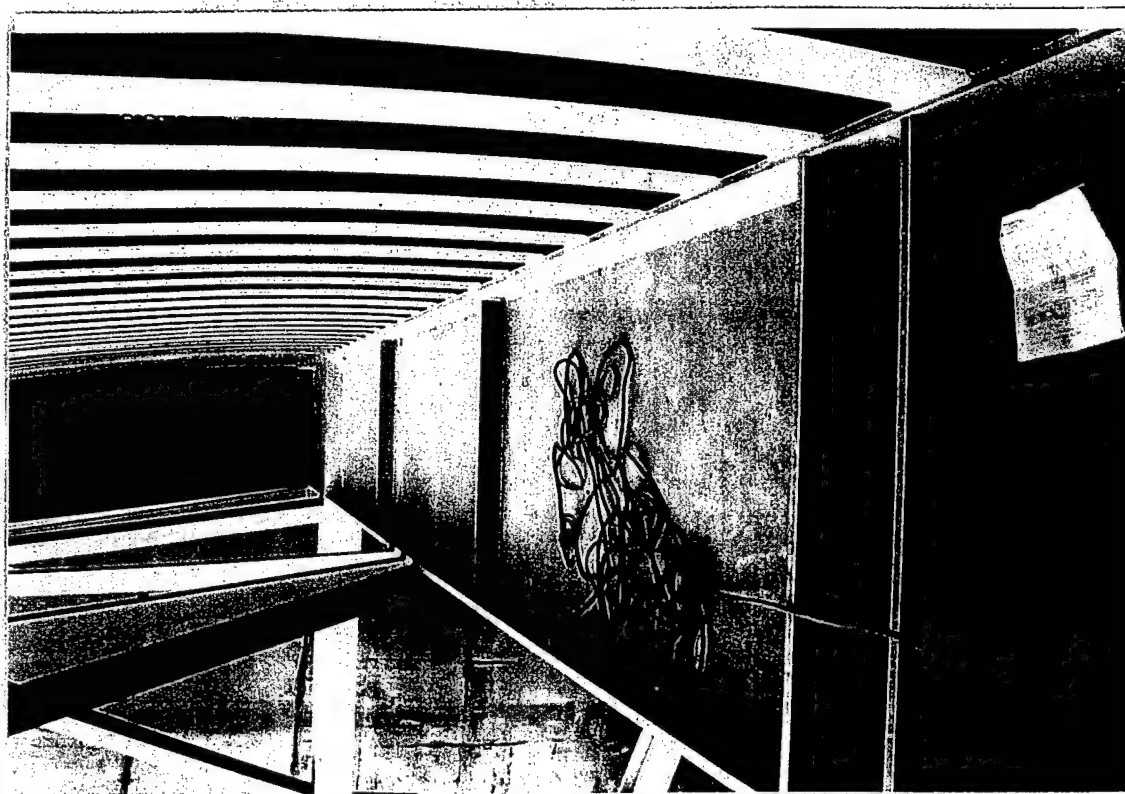


Lower  
Granite  
Dam

10/04/00

3-3

Gate 3  
Right end of top horizontal girder,  
typical.

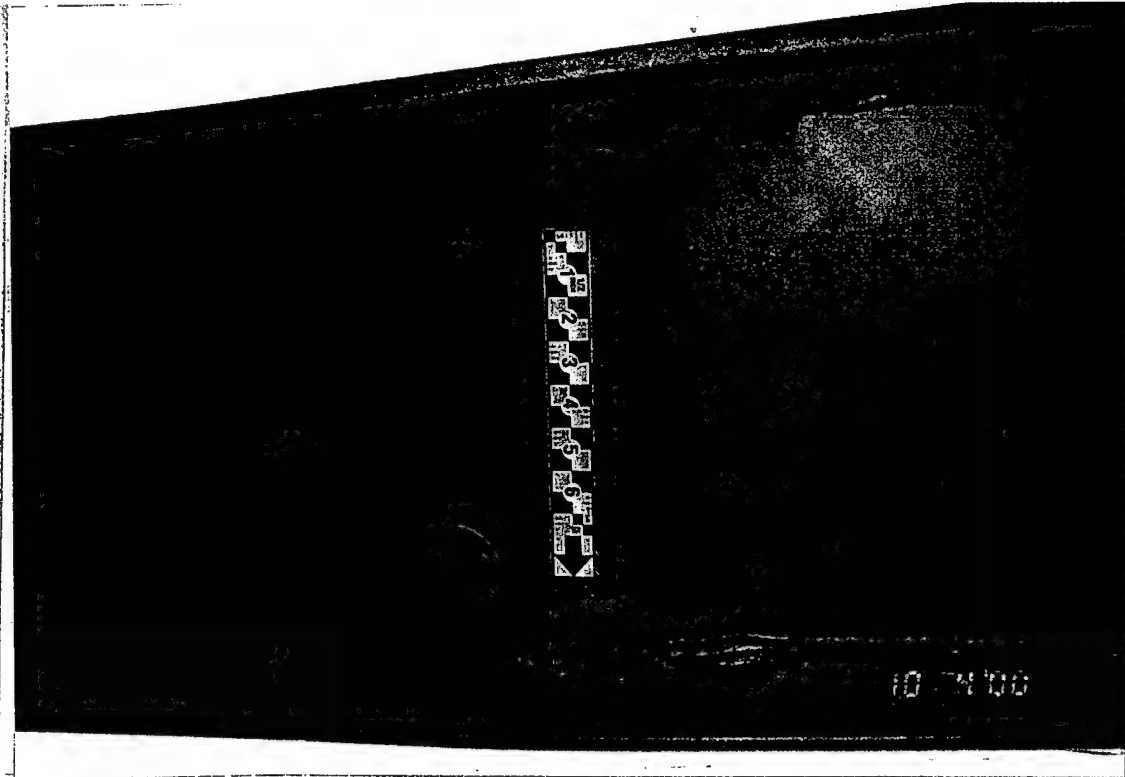


Lower  
Granite  
Dam

10/04/00

3-4

Gate 3  
Middle horizontal girder, typical.



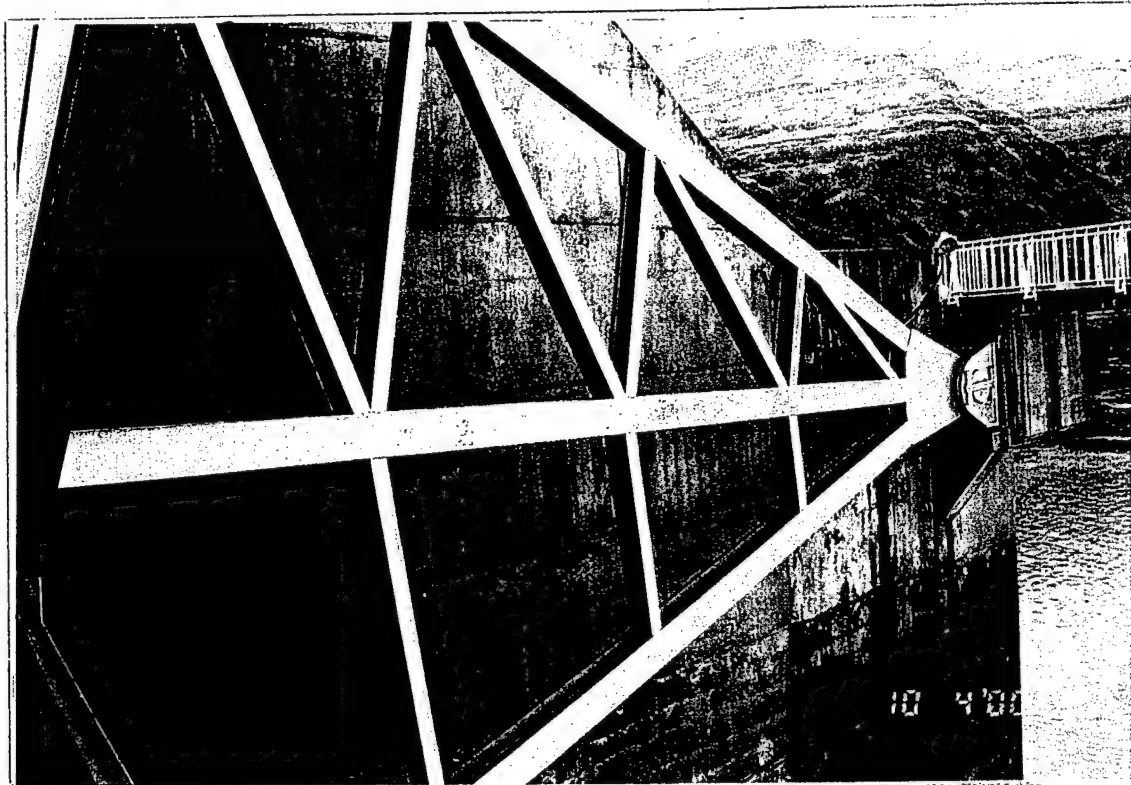
Lower  
Granite  
Dam

10/04/00

3-5

### Gate 3

Left frame, top end of Brace H.  
Coping in brace at weld to top radial  
strut, typical.



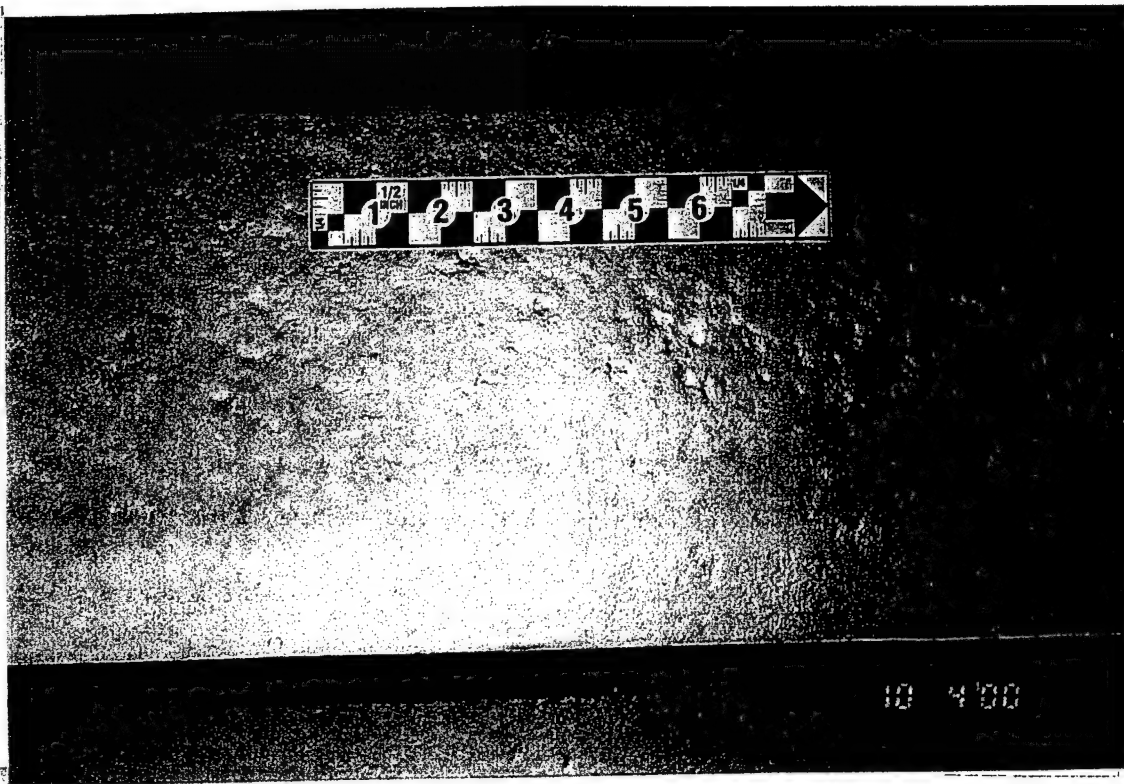
Lower  
Granite  
Dam

10/04/00

3-6

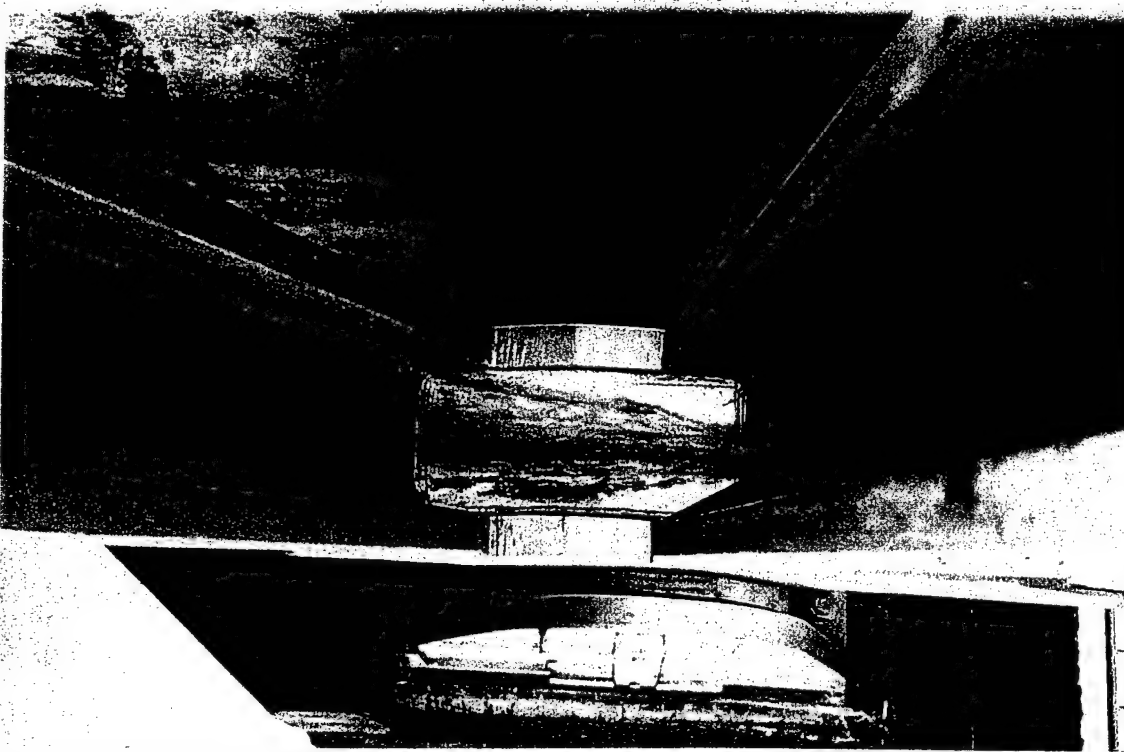
### Gate 3

Left frame, typical.



Lower  
Granite  
Dam  
10/04/00  
3-7

**Gate 3**  
Skin plate approx. 5' above middle  
horiz. girder, near left frame. Small  
pitting in skin plate, < 1/6" deep.



Lower  
Granite  
Dam  
10/04/00  
3-8

**Gate 3**  
Inside closure plate at right trunnion,  
looking downstream. Staining and  
light corrosion due to drain above.



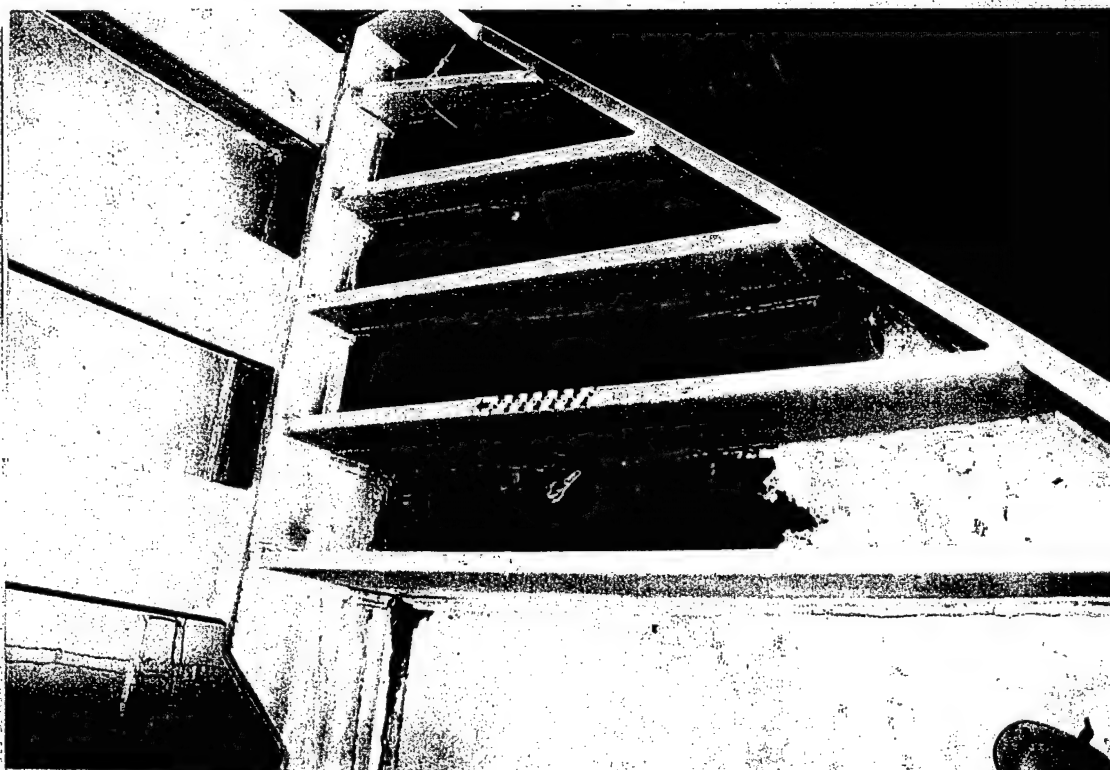
Lower  
Granite  
Dam

10/04/00

3-9

#### Gate 3

Outside of left trunnion and yoke,  
looking downstream. Note:  
lubrication lines and expelled  
lubrication beneath trunnion.



Lower  
Granite  
Dam

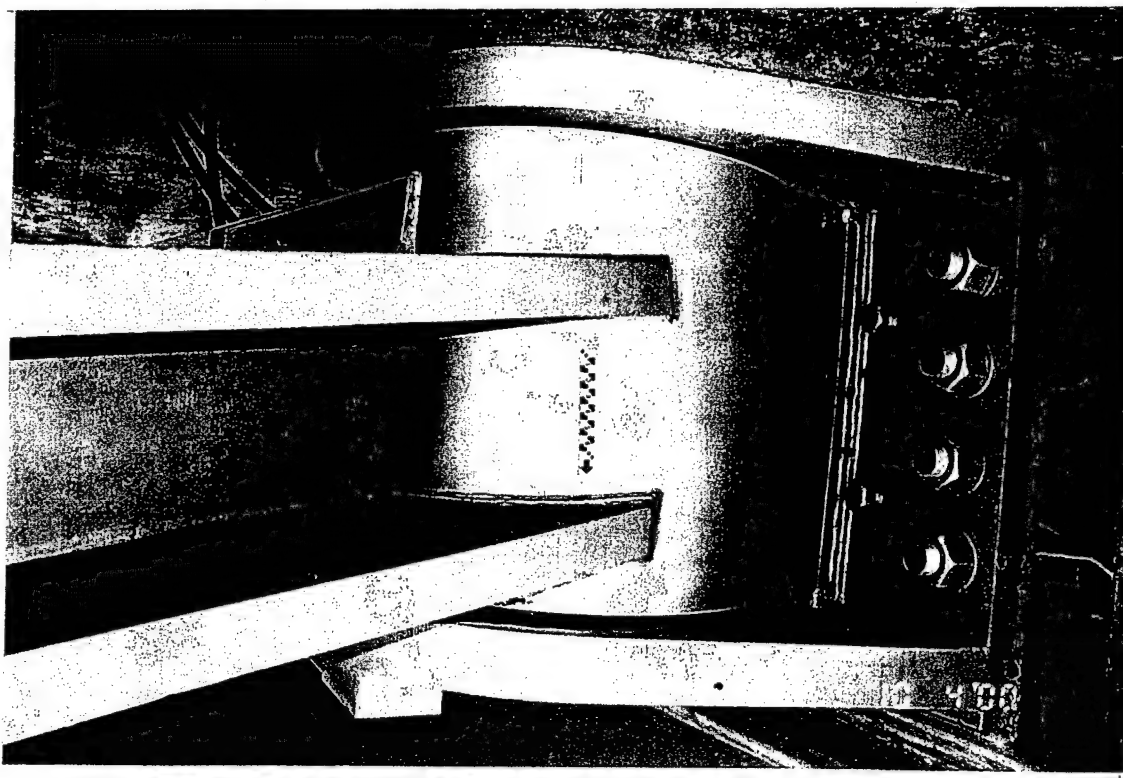
10/04/00

3-10

#### Gate 3

Left end of bottom horizontal girder.  
Standing water, no drainage between  
multiple stiffeners. Horizontal girder  
to skin plate stiffeners, debris and no  
drainage



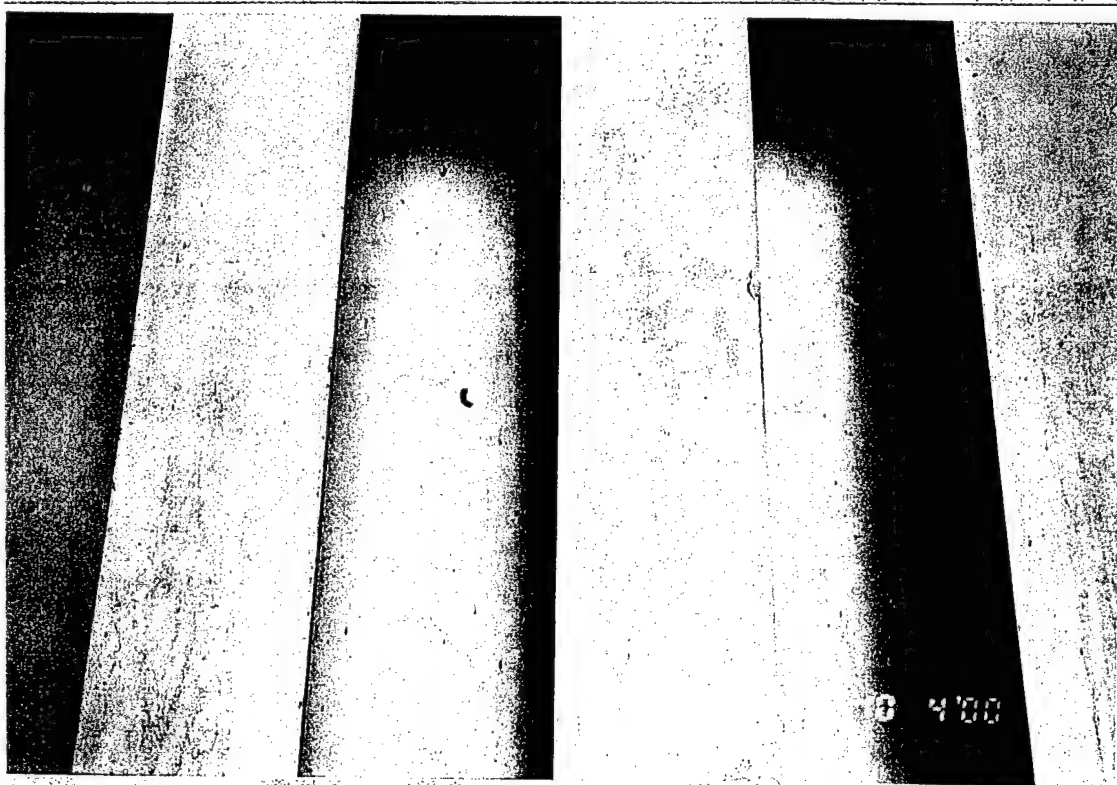


Lower  
Granite  
Dam

Gate 3  
Top of left trunnion, typical.

10/04/00

3-11

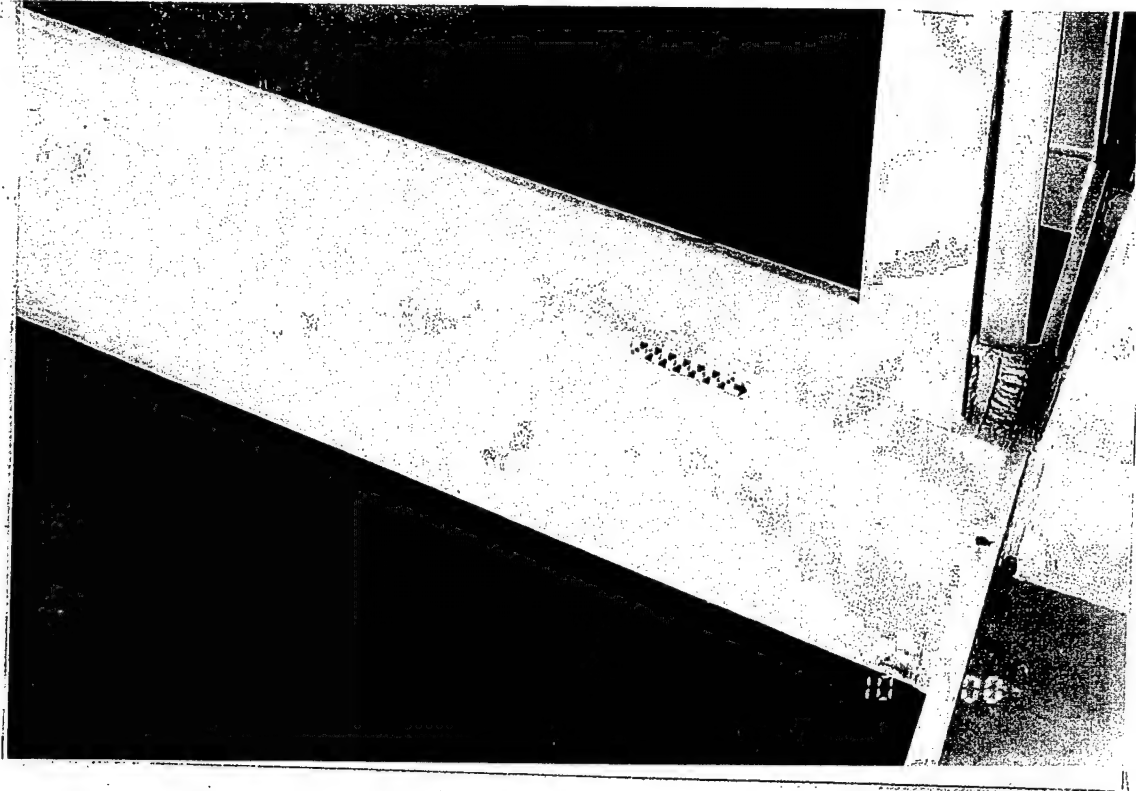


Lower  
Granite  
Dam

Gate 3  
Purlins and skin plate, typical.

10/04/00

3-12



Lower  
Granite  
Dam

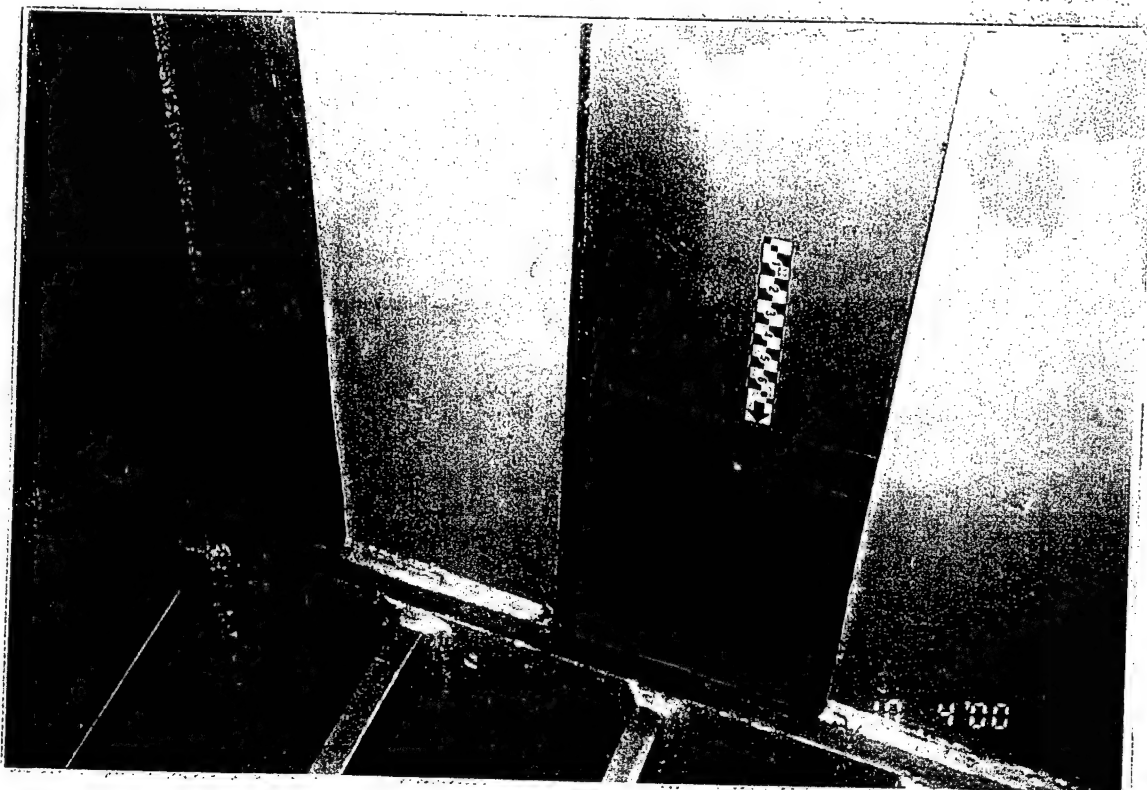
10/04/00

3-13

#### Gate 3

Upstream end of right frame, bottom  
radial strut. Grind marks in flange.

Note: Discoloration at welded joint  
to girder due to ultrasonic weld test  
gel.



Lower  
Granite  
Dam

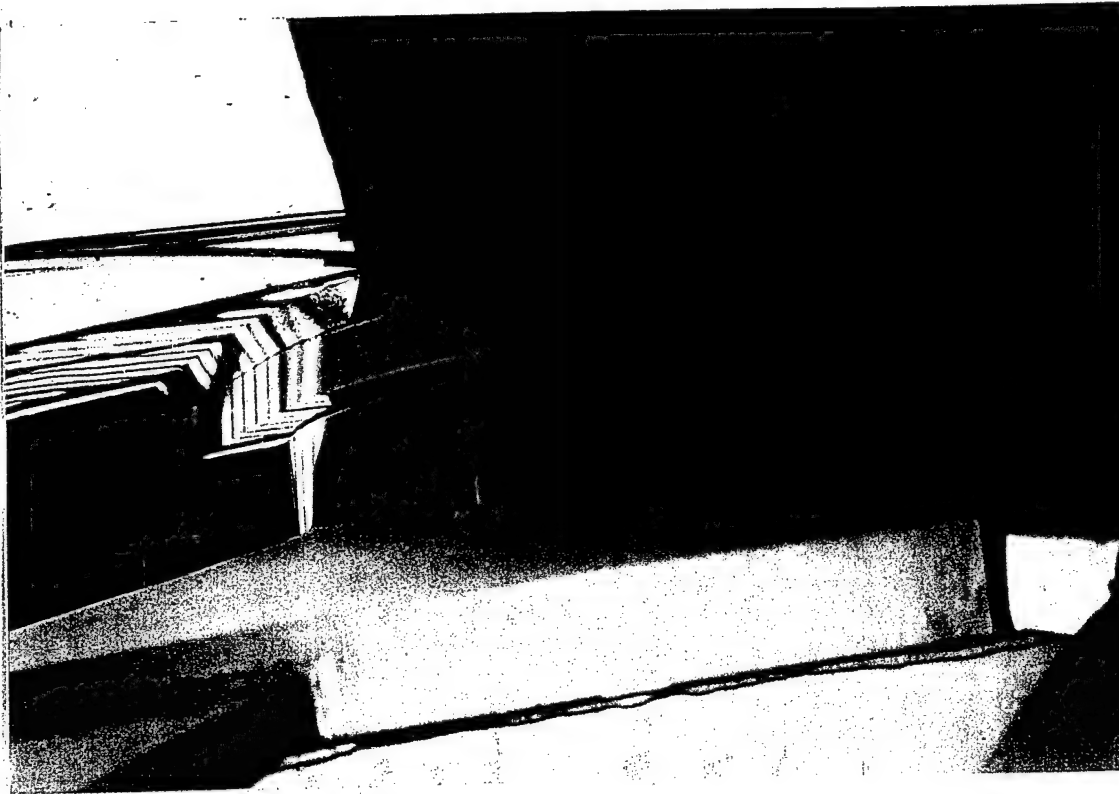
10/04/00

3-14

#### Gate 3

Right end of bottom horizontal  
girder. Horizontal girder to skin  
plate stiffeners, standing water,  
debris and no drainage



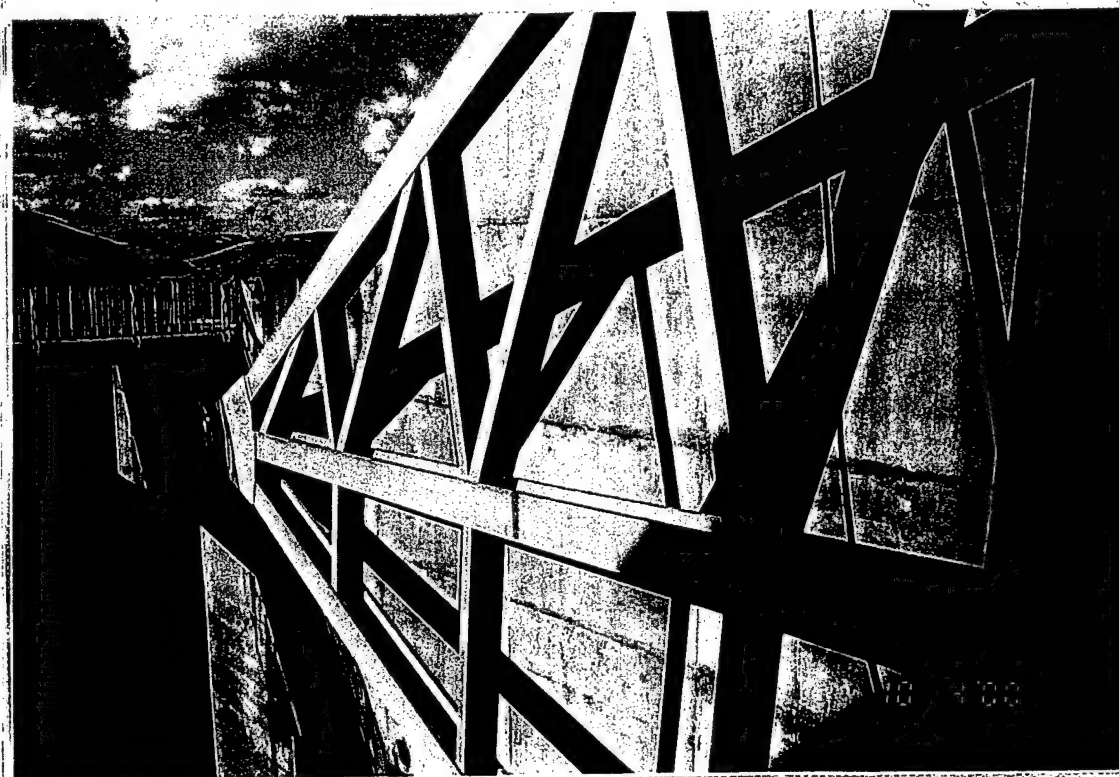


Lower  
Granite  
Dam

10/04/00

3-15

Gate 3  
Outside of right trunnion and yoke  
looking downstream, typical.

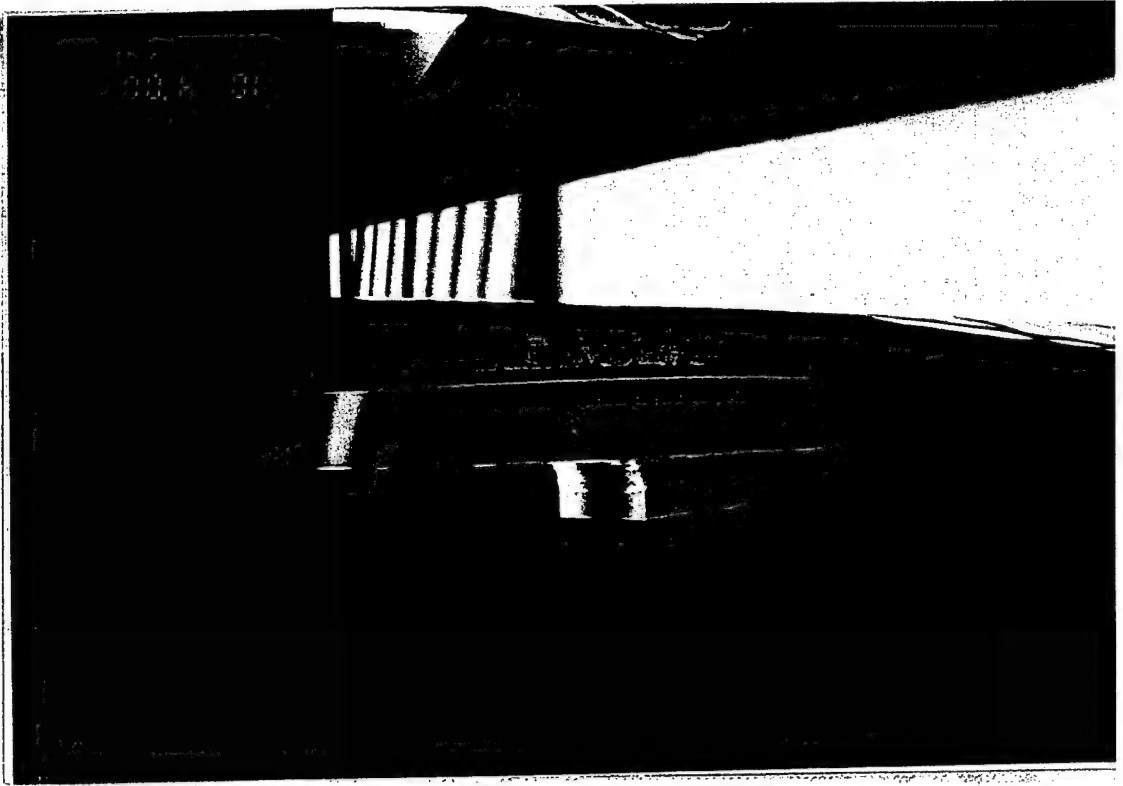


Lower  
Granite  
Dam

10/04/00

3-16

Gate 3  
Right frame, typical.

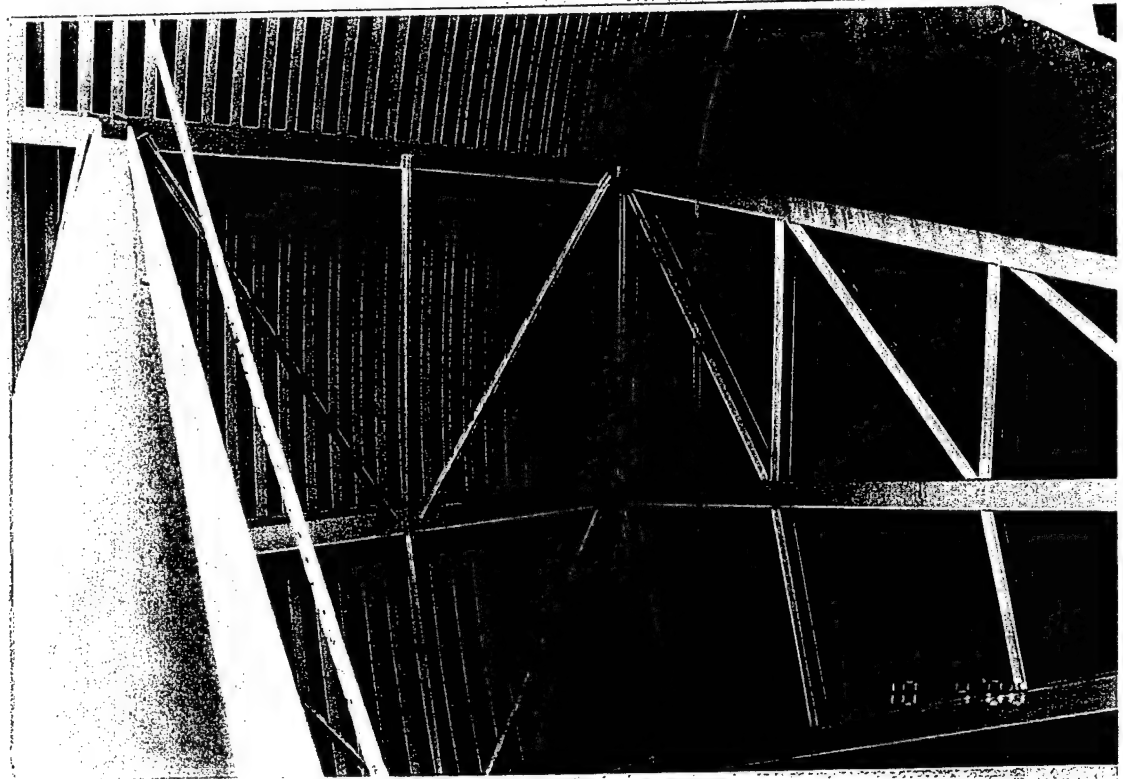


Lower  
Granite  
Dam

10/04/00

3-17

**Gate 3**  
Right trunnion and yoke looking  
downstream. Light corrosion on  
trunnion.

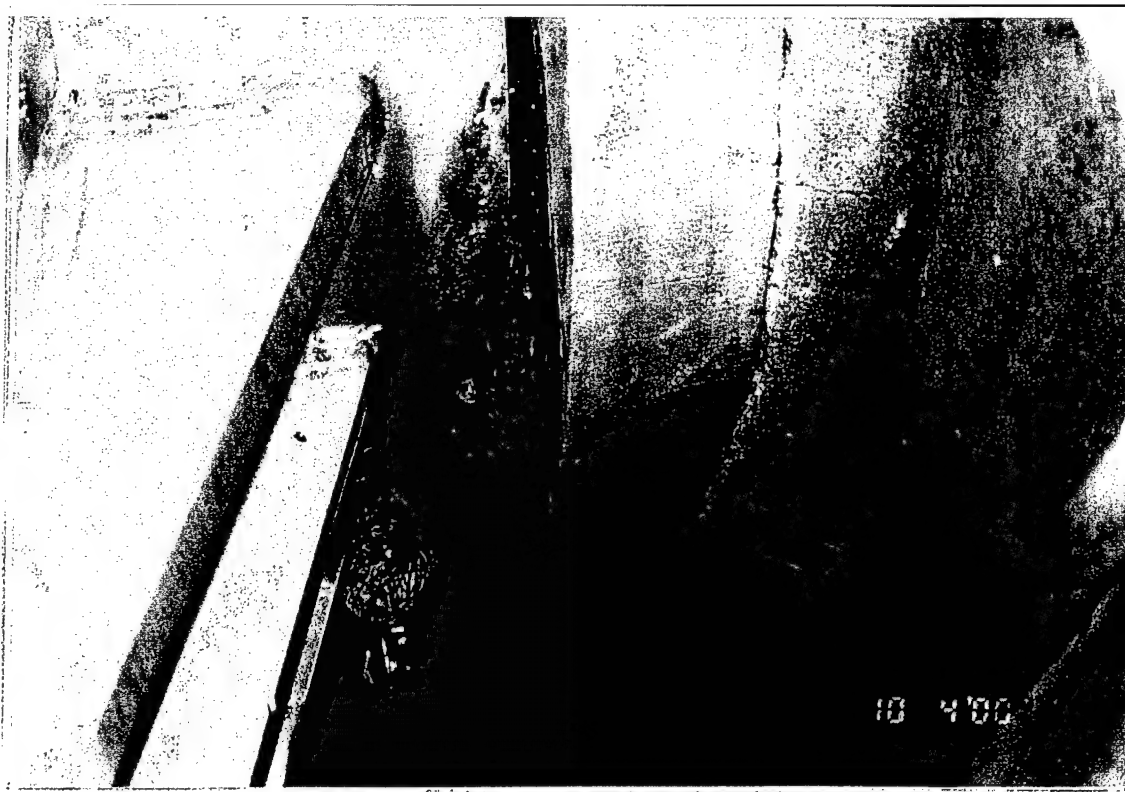


Lower  
Granite  
Dam

10/04/00

3-18

**Gate 3**  
Gate face and left frame, typical.



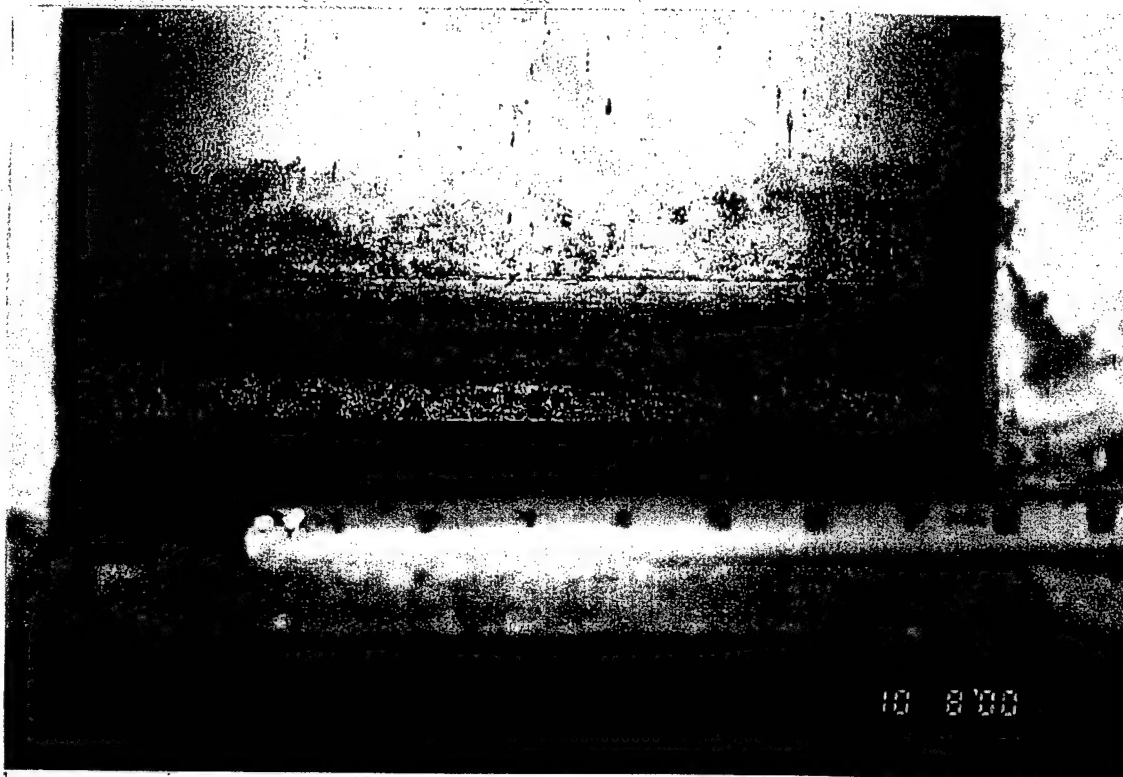
Lower  
Granite  
Dam

10/04/00

3-19

#### Gate 3

Close-up of upstream side of right trunnion and yoke. Note: Small lubrication leak at connection to trunnion.



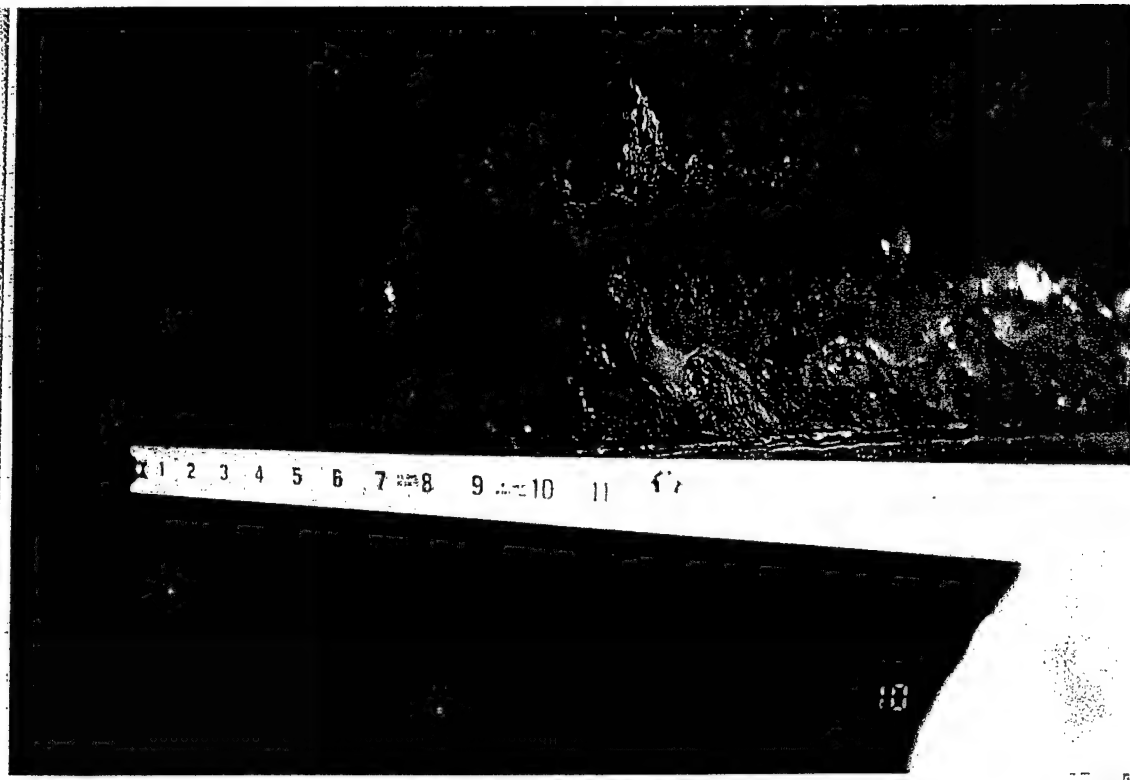
Lower  
Granite  
Dam

10/08/00

3-20

#### Gate 3

Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.



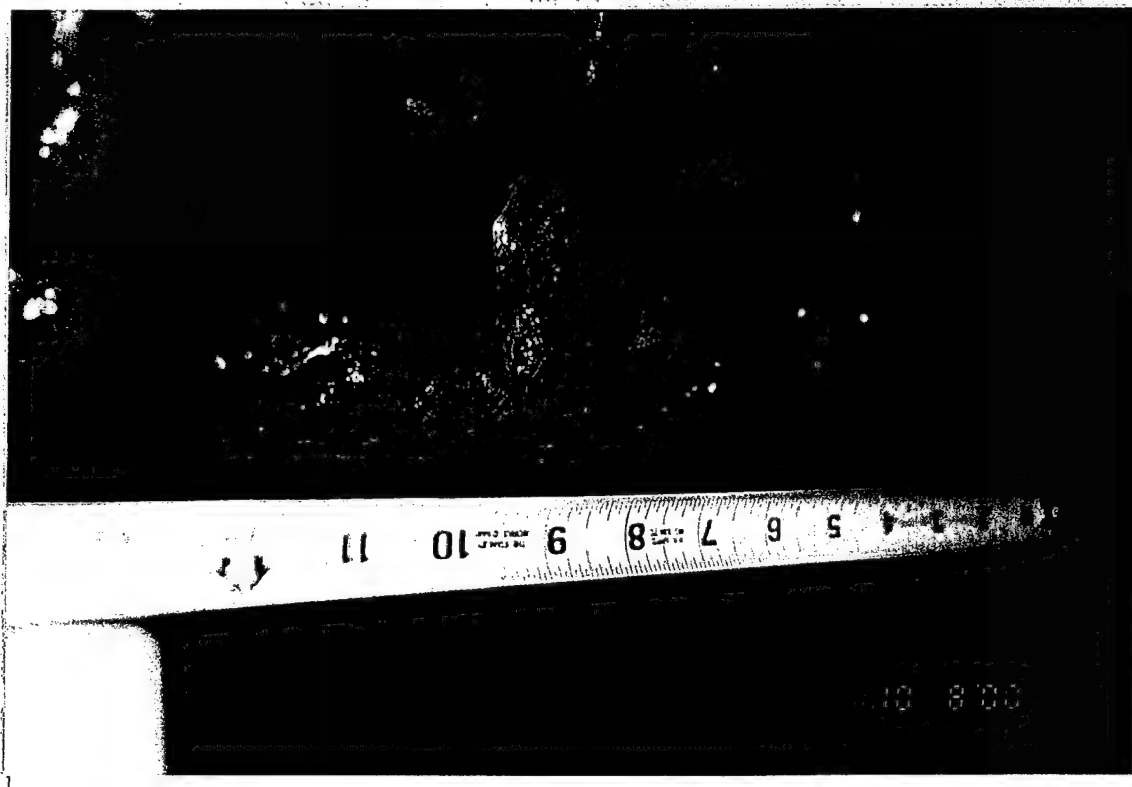
Lower  
Granite  
Dam

10/08/00

3-21

#### Gate 3

Upstream side of skin plate at  
bottom seal. Light to moderate  
corrosion of skin plate, typical.



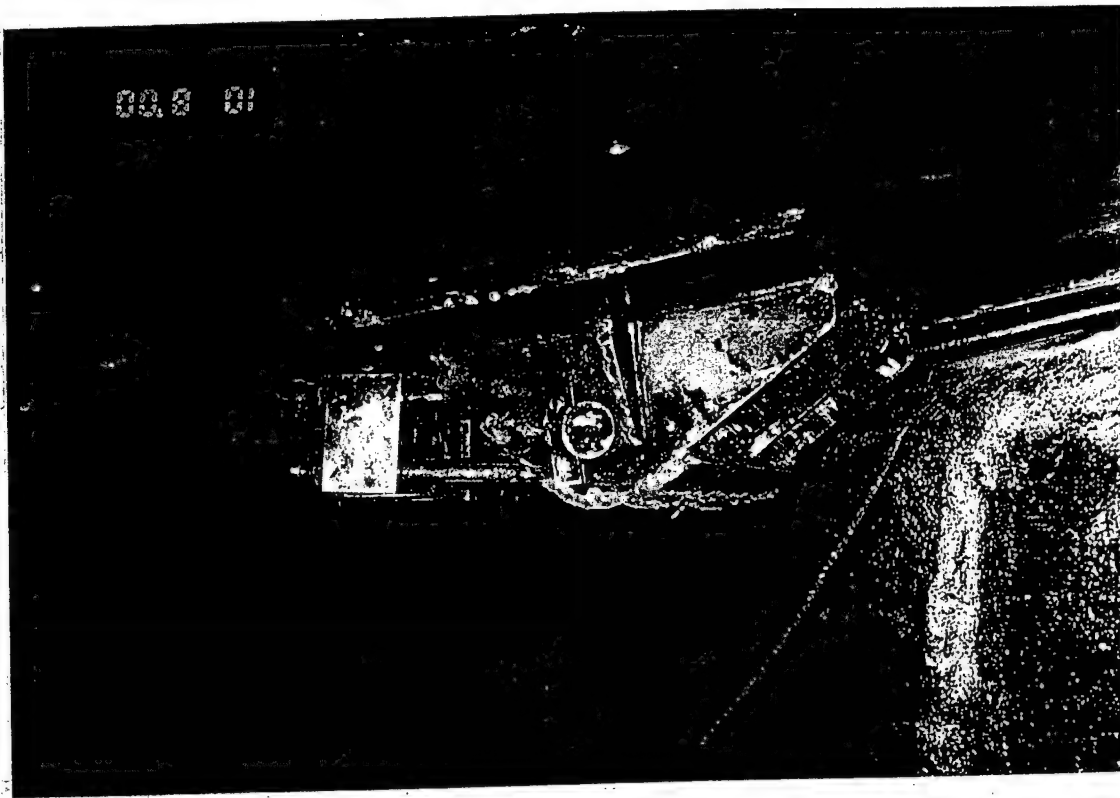
Lower  
Granite  
Dam

10/08/00

3-22

#### Gate 3

Upstream side of skin plate at  
bottom seal. Light to moderate  
corrosion of skin plate, typical.



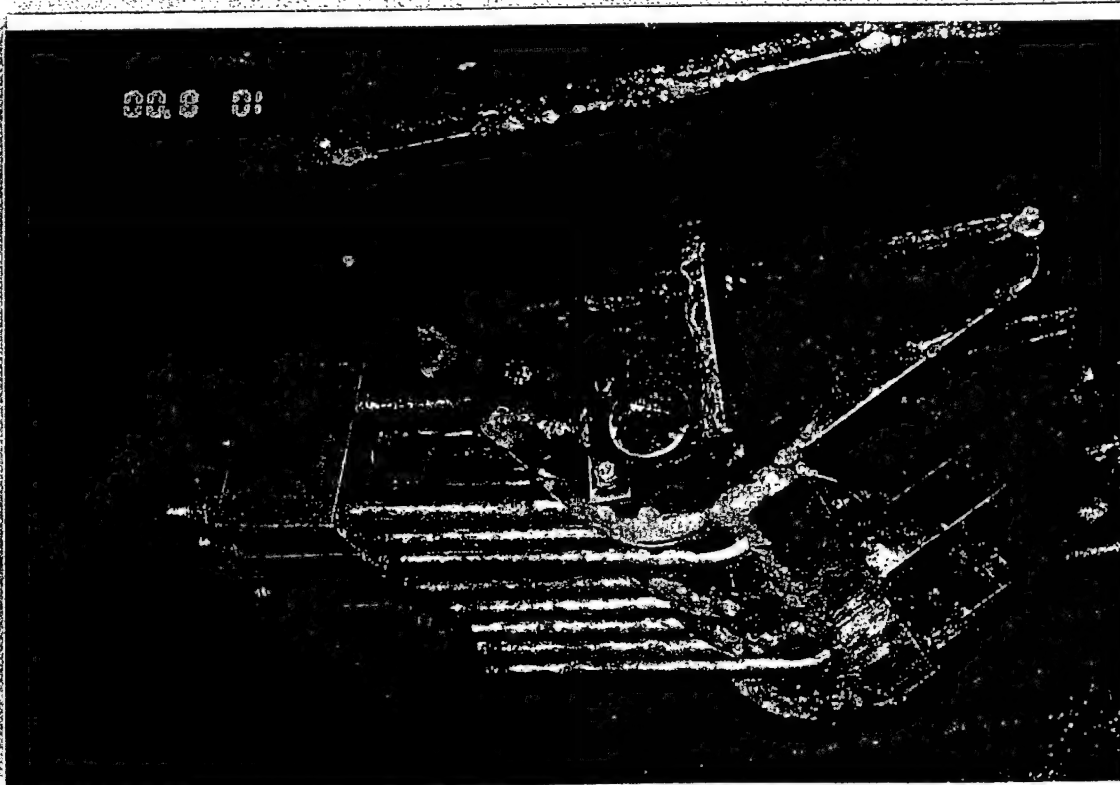
Lower  
Granite  
Dam

10/08/00

3-23

#### Gate 3

Left side hoist connection. Light corrosion on lifting lugs and plates.  
Note: excellent condition of stainless steel U-bolts.



Lower  
Granite  
Dam

10/08/00

3-24

#### Gate 3

Left side hoist connection. Light corrosion on lifting lugs and plates.  
Note: excellent condition of stainless steel U-bolts.

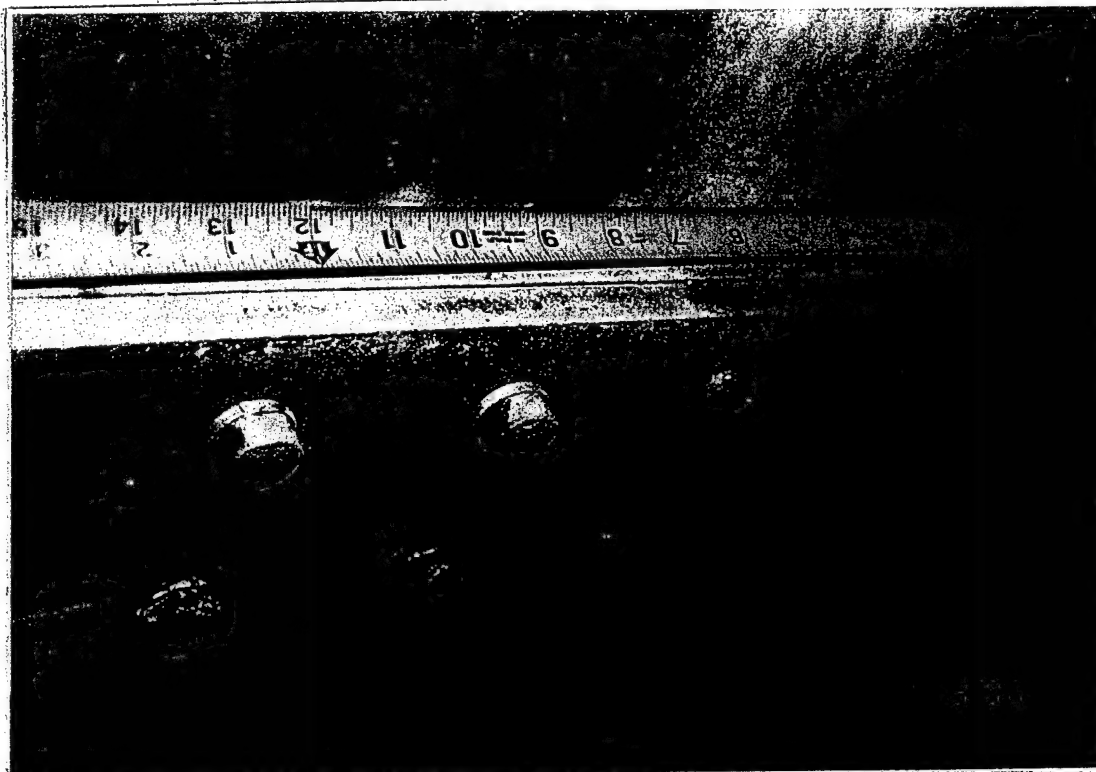


Lower  
Granite  
Dam

**Gate 3**  
Skin plate pitting, looking up,  
typical.

10/08/00

3-25



Lower  
Granite  
Dam

**Gate 3**  
Downstream side of bottom seal and  
keeper plate looking upstream.

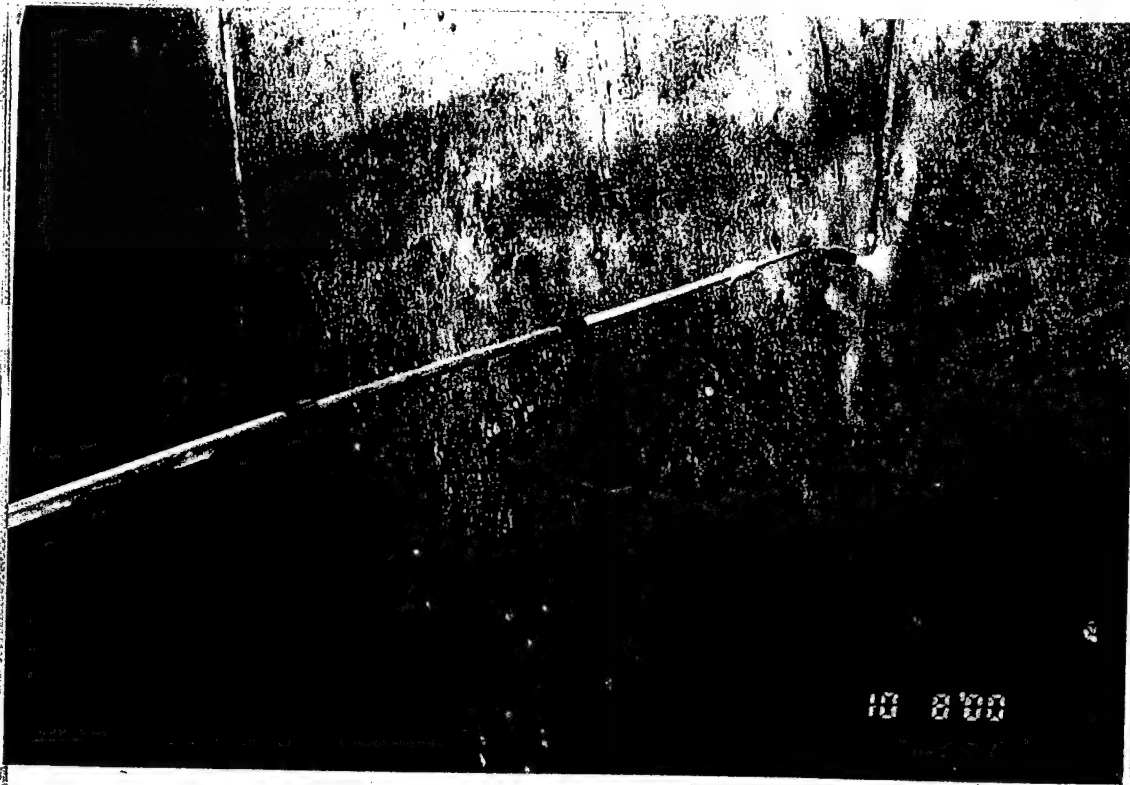
10/08/00

3-26



Lower Granite Dam  
Gate 3  
Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.

10/08/00  
3-27



Lower Granite Dam  
Gate 3  
Waterblasting and typical skin plate condition.

10/08/00

3-28

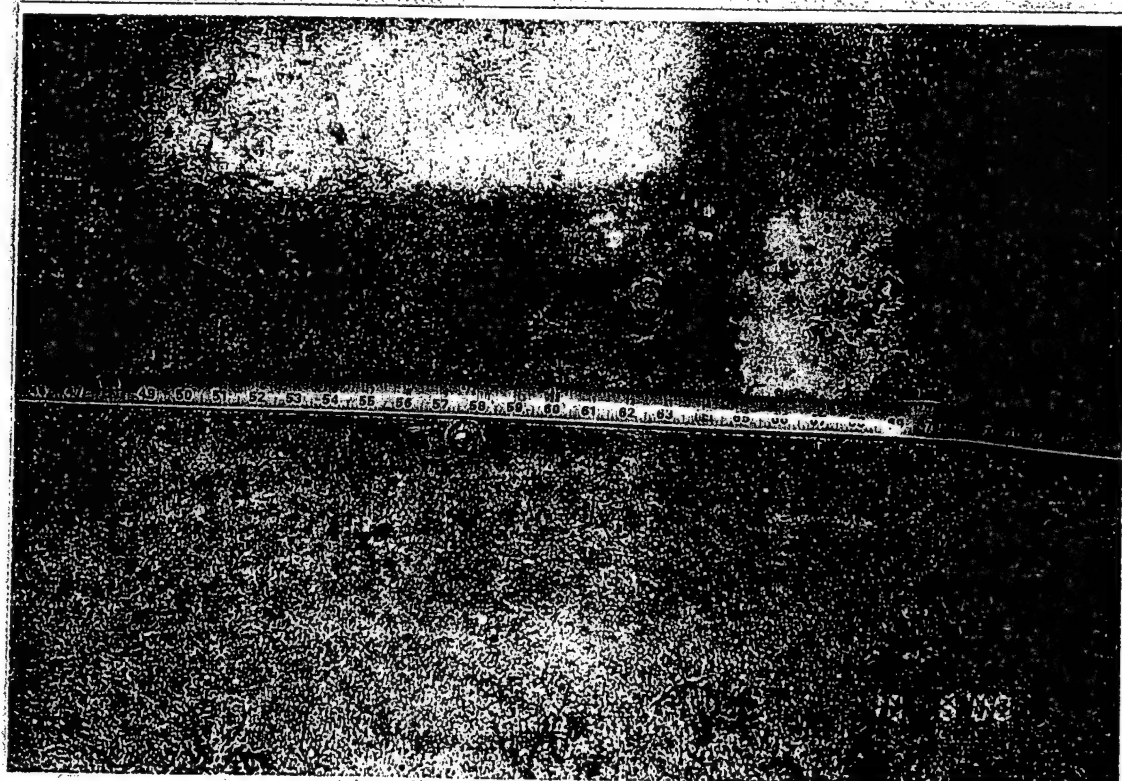




Lower Gate 3  
Granite Skin plate pitting, typical.  
Dam

10/08/00

3-29



Lower Gate 3  
Granite Skin plate pitting, typical.  
Dam

10/08/00

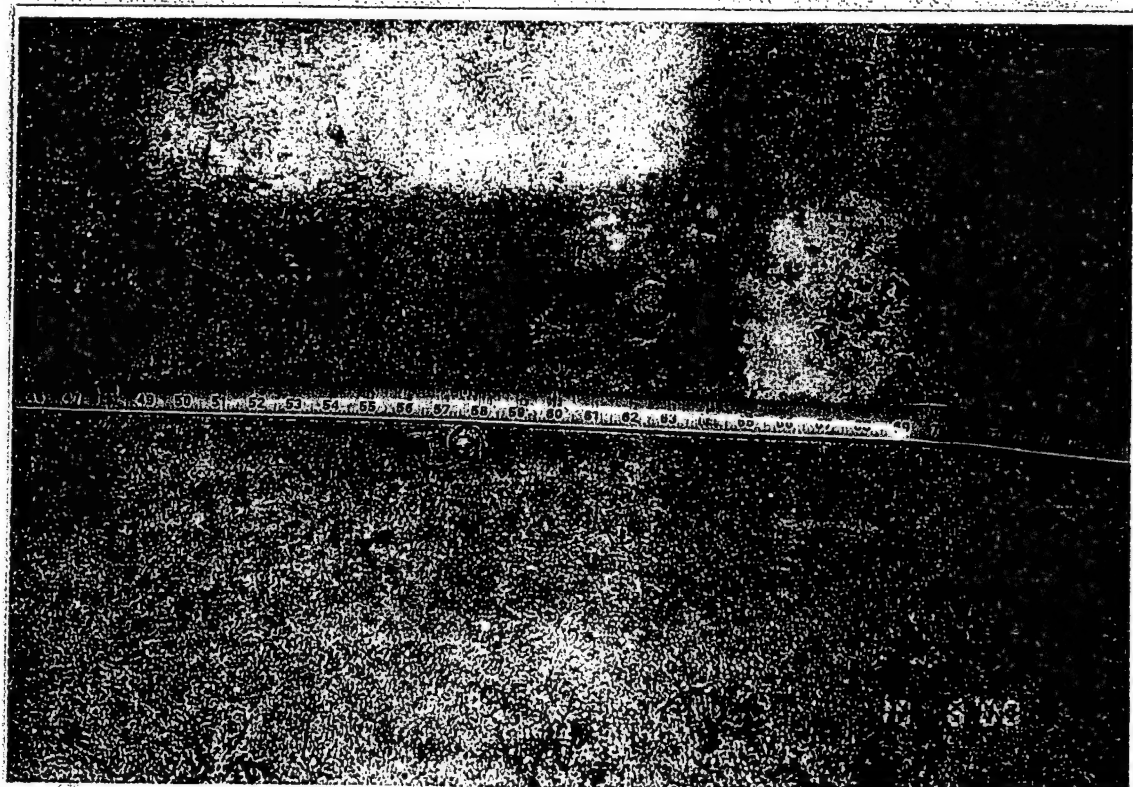
3-30



Lower Gate 3  
Granite Skin plate pitting, typical.  
Dam

10/08/00

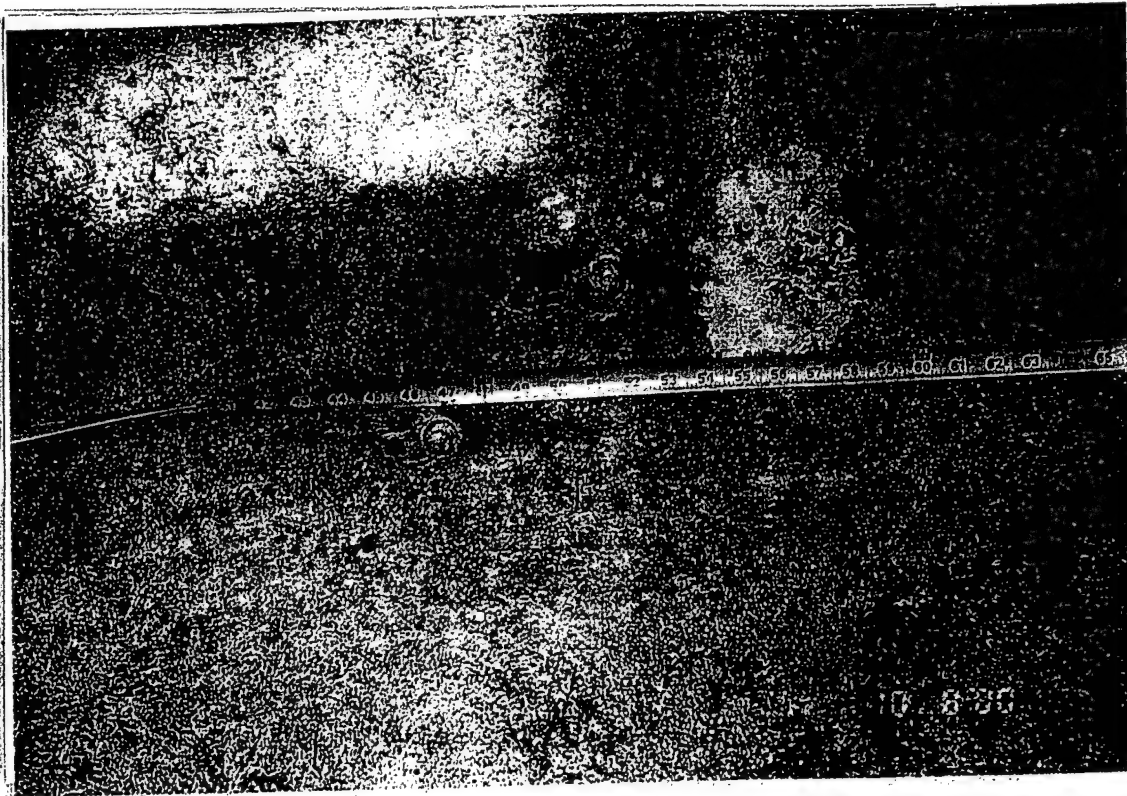
3-29



Lower Gate 3  
Granite Skin plate pitting, typical.  
Dam

10/08/00

3-30

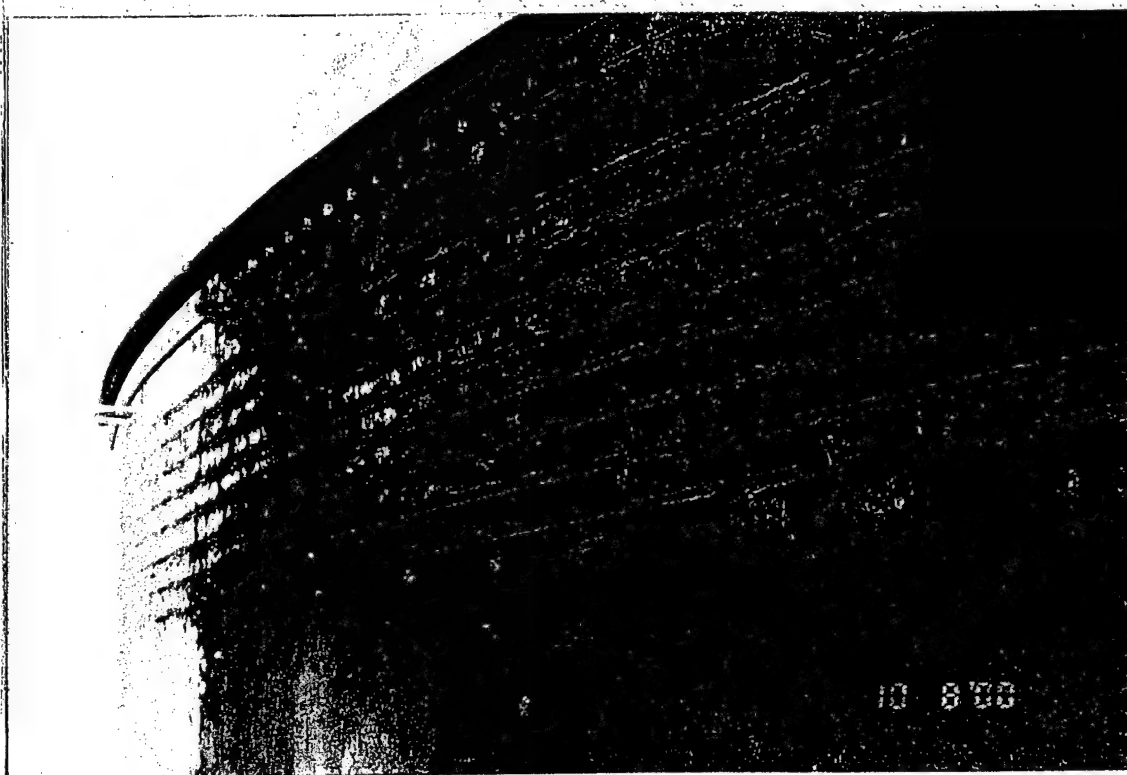


Lower  
Granite  
Dam

10/08/00

3-31

Gate 3  
Skin plate pitting, typical.

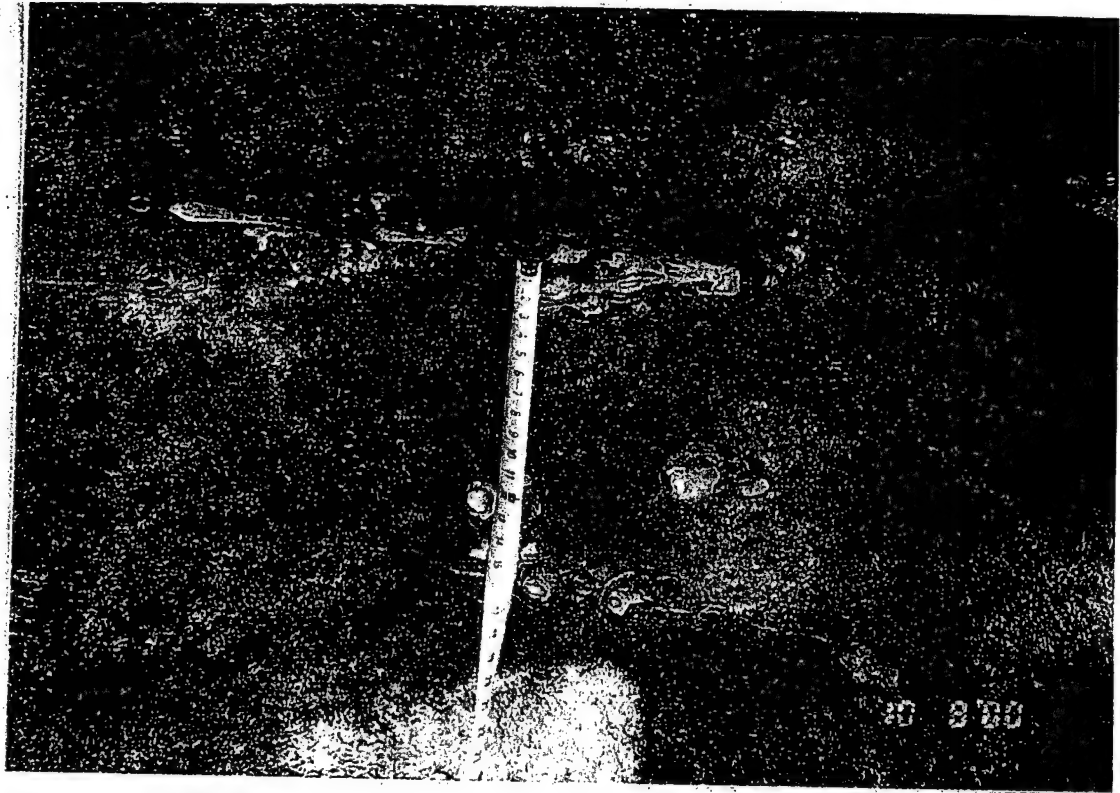


Lower  
Granite  
Dam

10/08/00

3-32

Gate 3  
Typical wear plate condition. Light  
grooves due to cable wear, light to  
moderate corrosion.

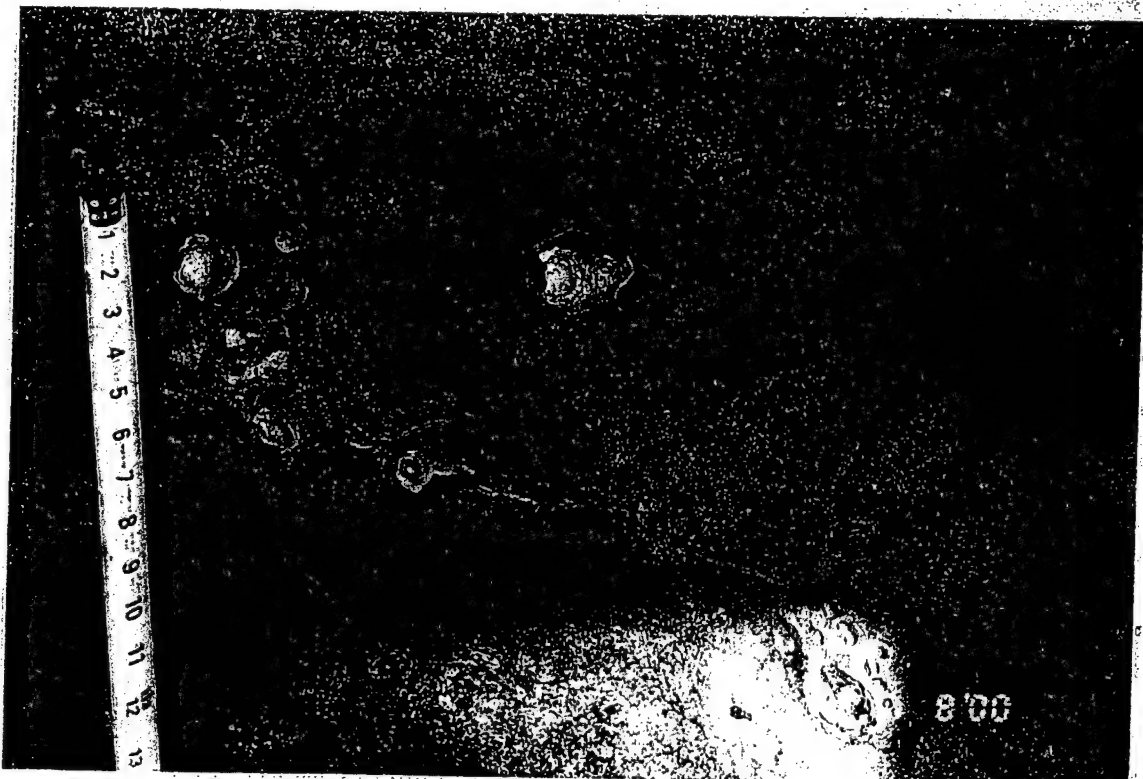


Lower  
Granite  
Dam

10/08/00

3-33

Gate 3  
Skin plate pitting apparently  
associated with scratches.

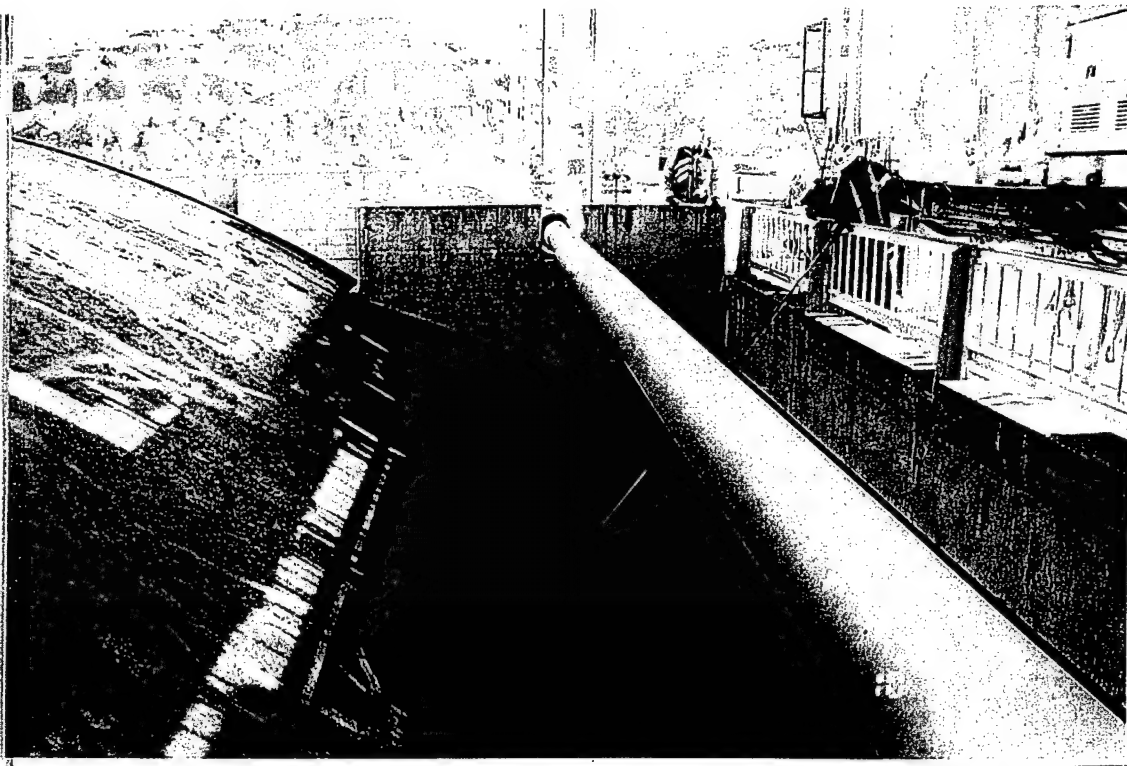


Lower  
Granite  
Dam

10/08/00

3-34

Gate 3  
Skin plate pitting apparently  
associated with scratches.



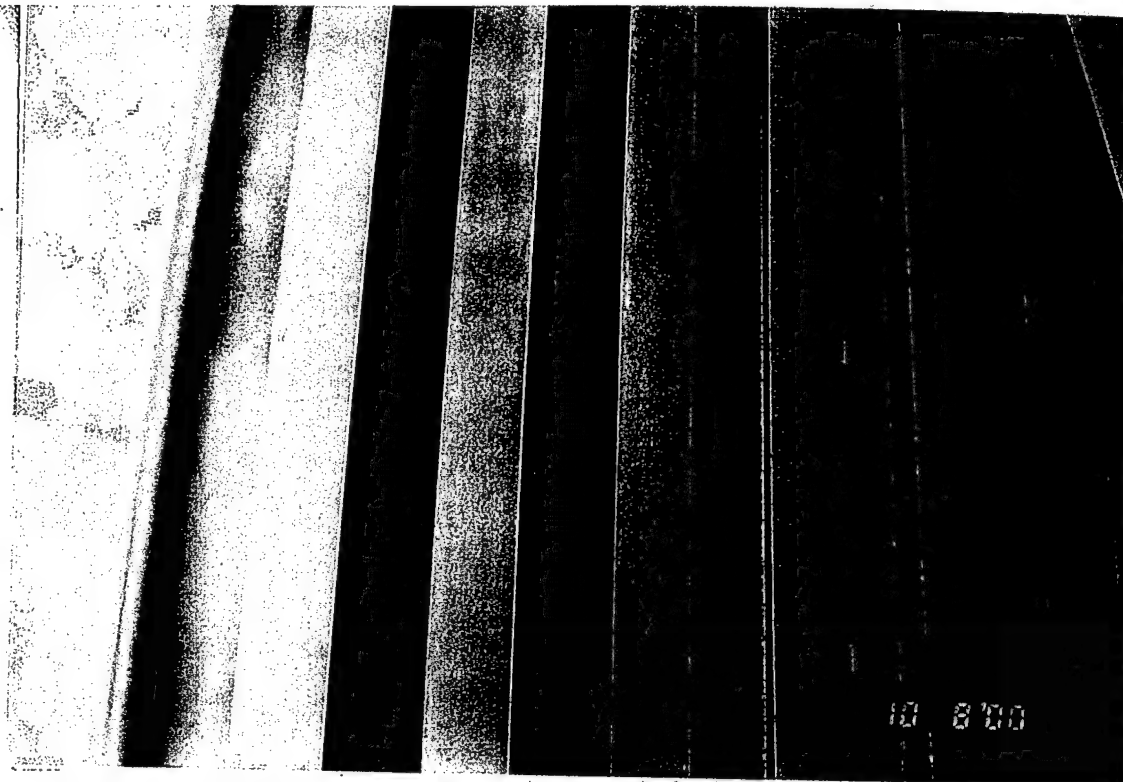
Lower  
Granite  
Dam

Gate 3  
Waterblasting upstream surface of  
skin plate.

10/08/00

3-35





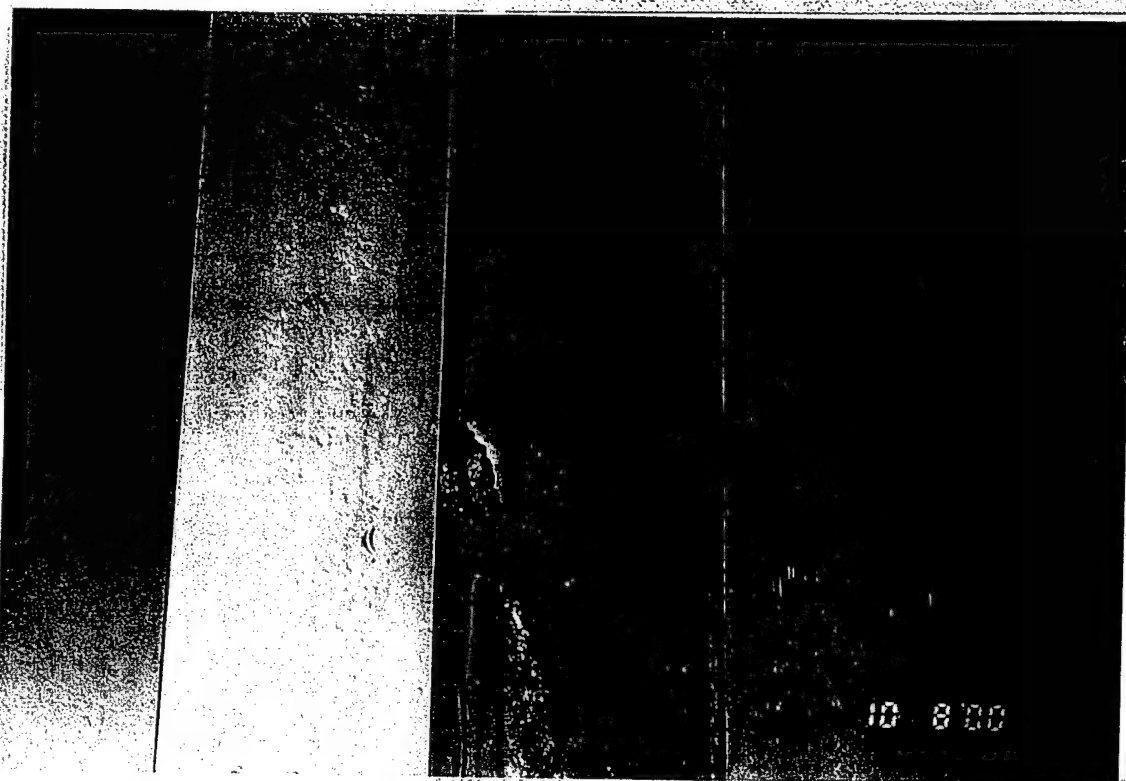
Lower  
Granite  
Dam

10/08/00

4-1

#### Gate 4

Paint blister and apparent skin plate leak approximately 7' from left side of gate and 6' above 1/2" to 3/8" skin plate transition. Photo taken after waterblasting of upstream side.



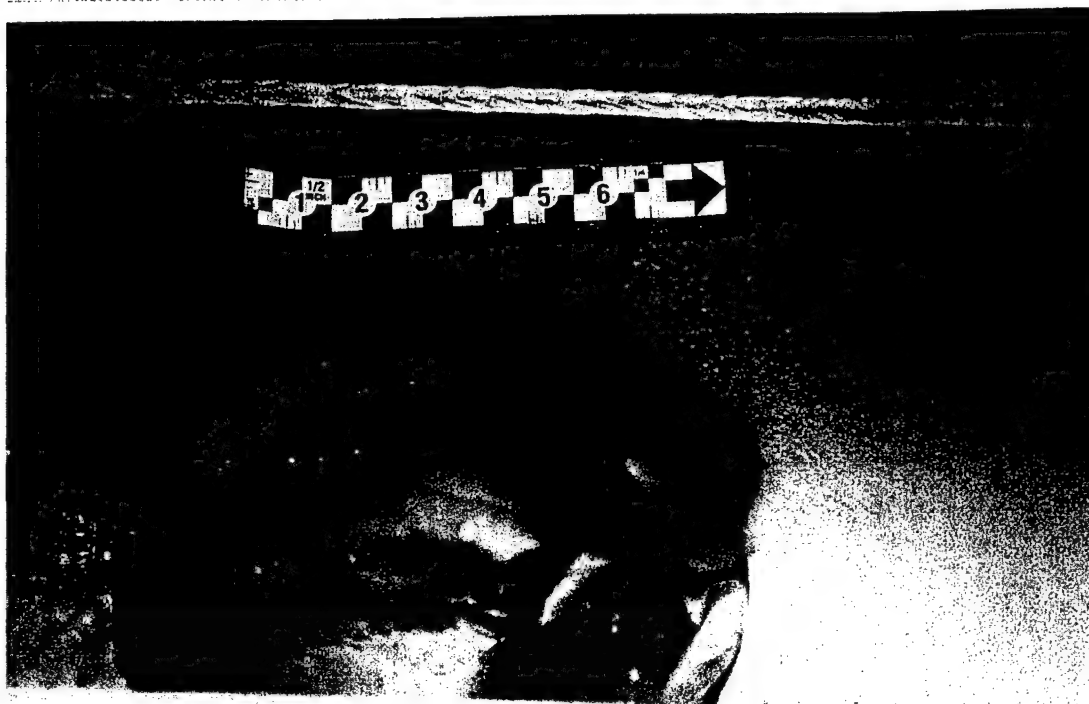
Lower  
Granite  
Dam

10/08/00

4-2

#### Gate 4

Paint blister and apparent skin plate leak approximately 7' from left side of gate and 6' above 1/2" to 3/8" skin plate transition. Photo taken after waterblasting of upstream side.

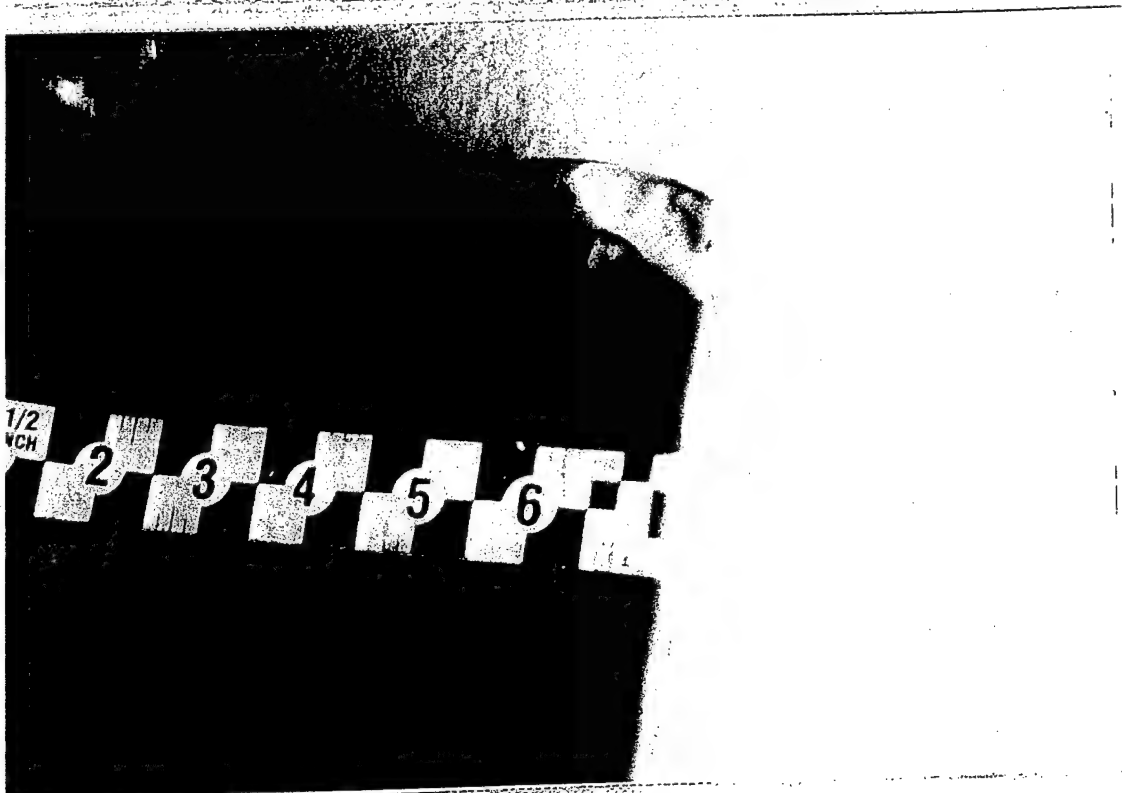


Lower  
Granite  
Dam

Gate 4  
Close-up of paint blister / skin plate  
leak.

10/08/00

4-3



Lower  
Granite  
Dam

Gate 4  
Skin plate leak after removal of paint  
blister.

10/08/00



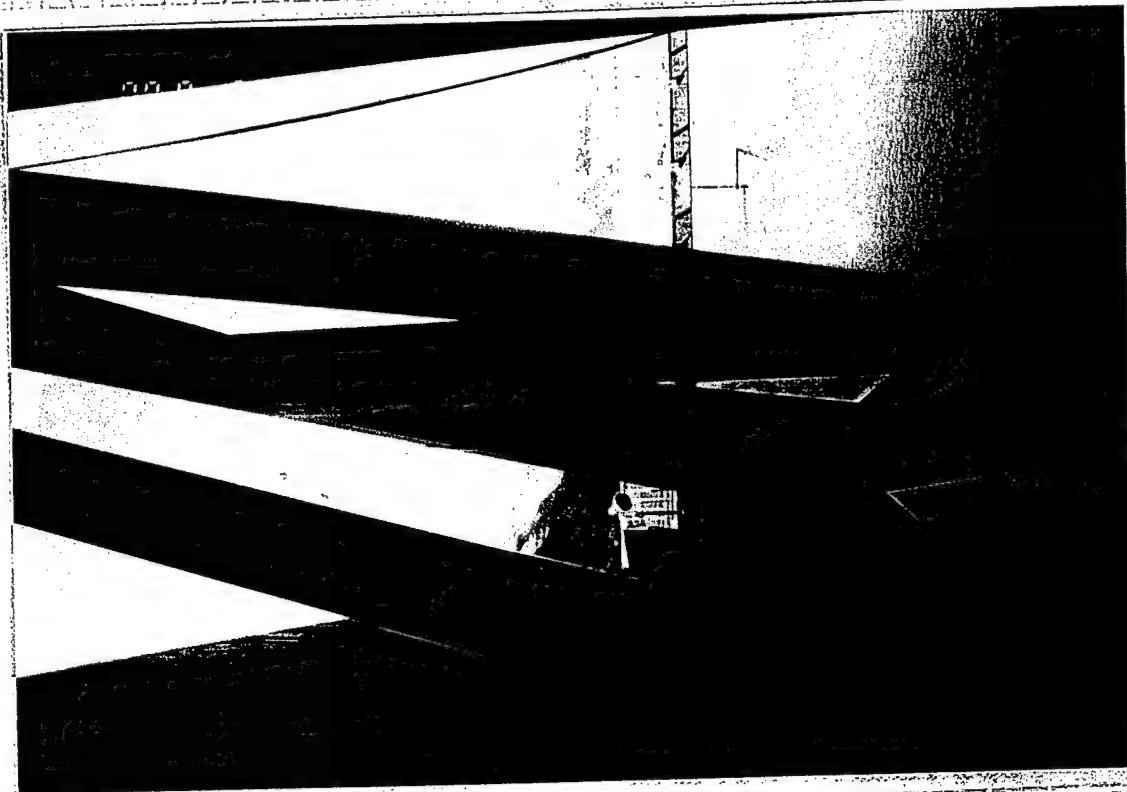


Lower  
Granite  
Dam

10/08/00

4-5

Gate 4  
Skin plate leak after removal of paint  
blister.

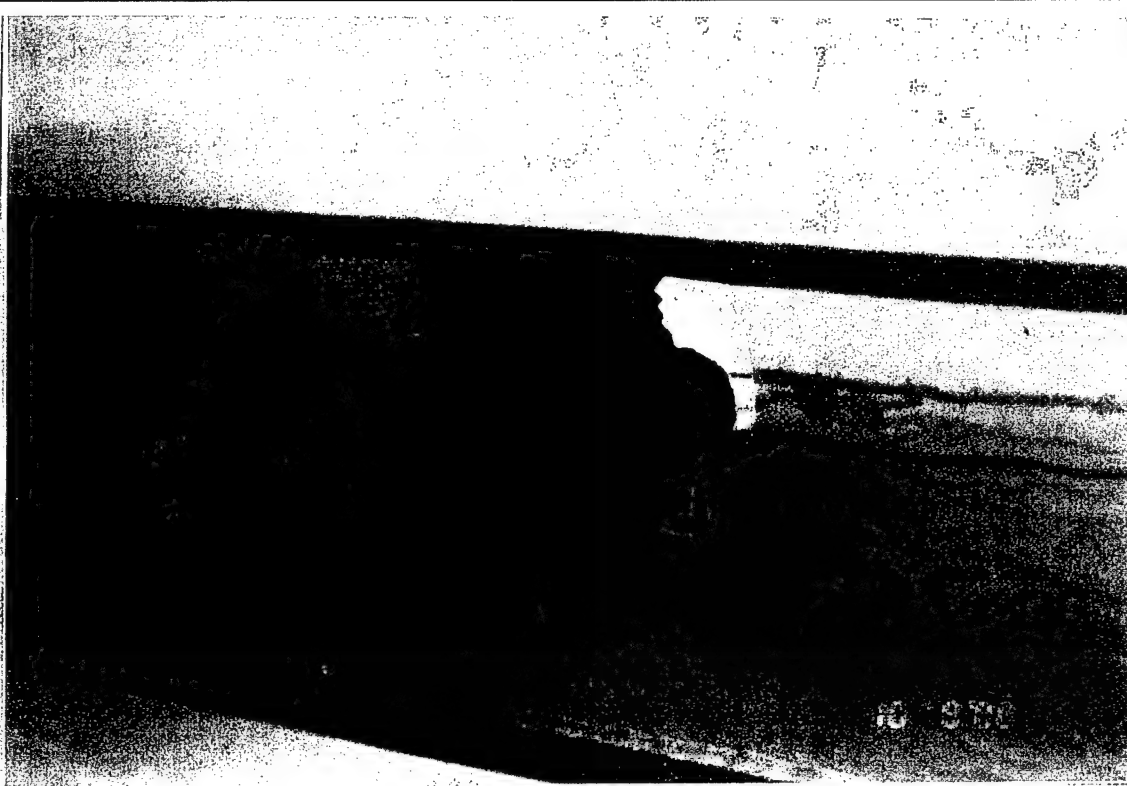


Lower  
Granite  
Dam

10/08/00

4-6

Gate 4  
Left side frame, along outside of  
frame looking downstream, typical.  
Note: Skin plate leak landing on  
middle radial strut.



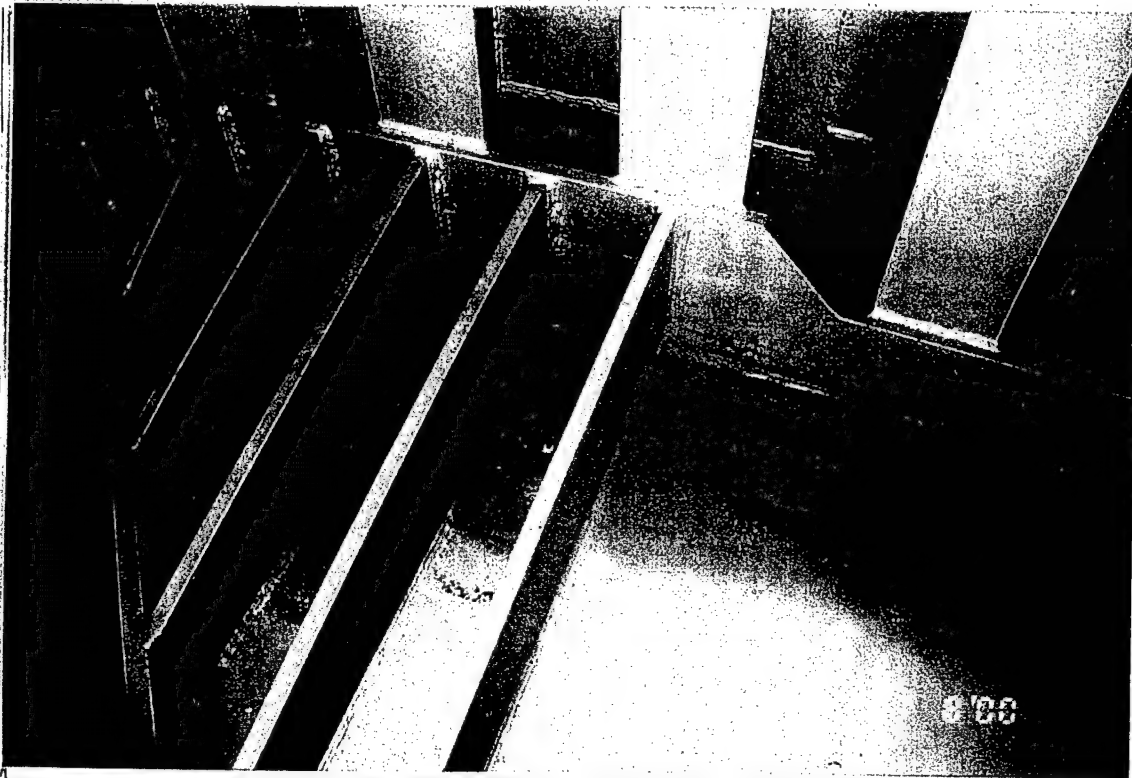
Lower  
Granite  
Dam

10/08/00

4-7

**Gate 4**

Skin plate leak after removal of paint  
blister.



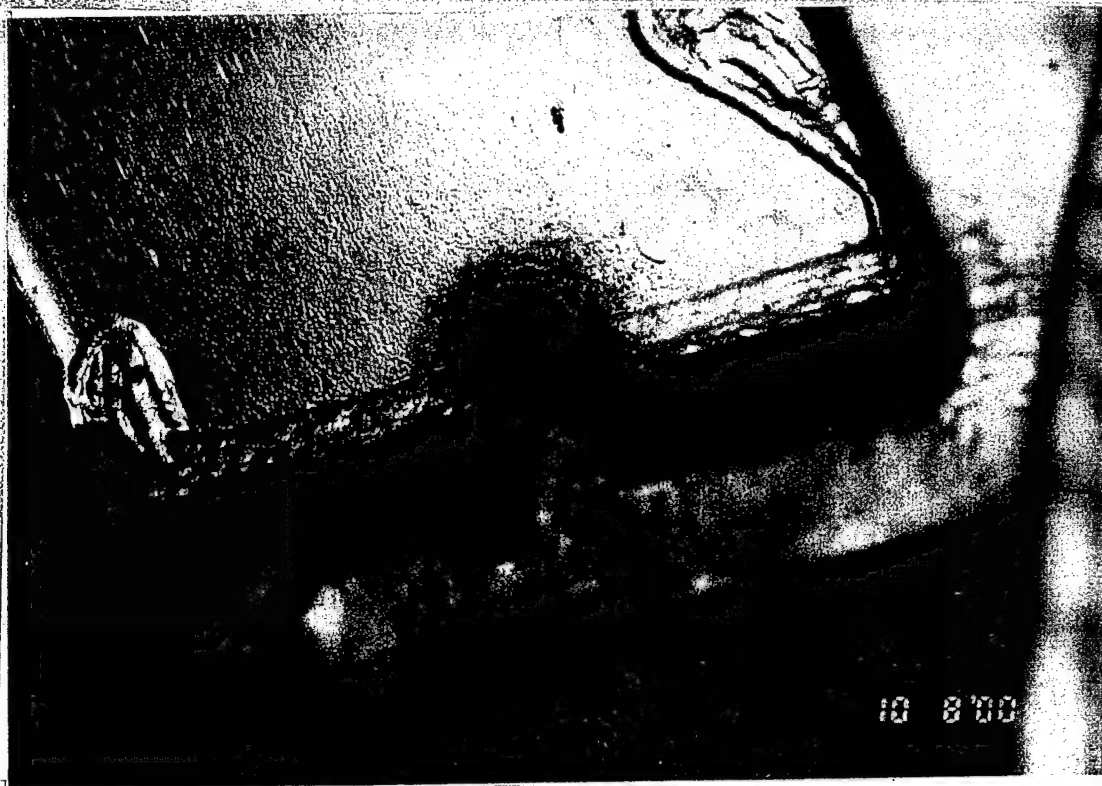
Lower  
Granite  
Dam

10/08/00

4-8

**Gate 4**

Right end of bottom horiz. girder.  
Evidence of standing water, no  
drainage between multiple stiffeners.  
Horiz. girder to skin plate stiffeners,  
debris and no drainage



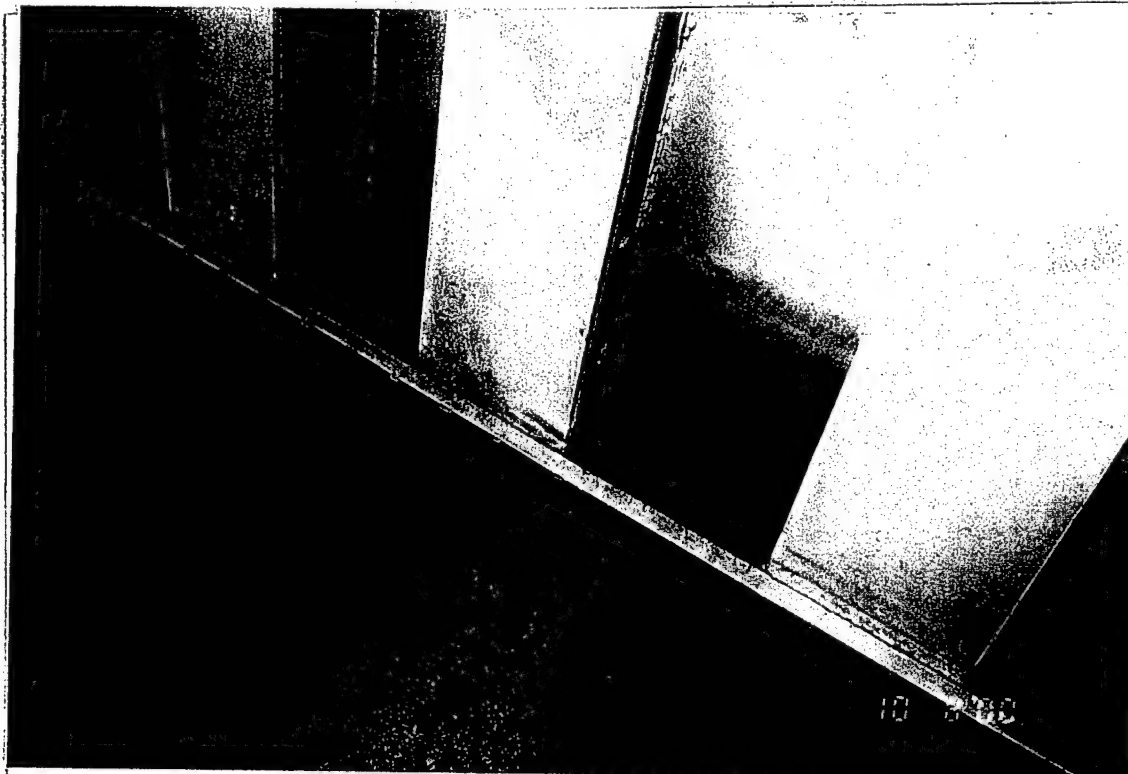
Lower  
Granite  
Dam

**Gate 4**

Bottom of upstream end of bottom  
radial strut, drain hole, typical.

10/08/00

4-9



Lower  
Granite  
Dam

**Gate 4**

Bottom seal closure plate looking  
upstream. Standing water between  
closure plate, purlin webs and  
skinplate. Typical.

10/08/00

4-10



Lower  
Granite  
Dam

10/08/00

4-11

**Gate 4**

Right frame, Brace F. Small deformation, approx. 1/8" on outside flange.



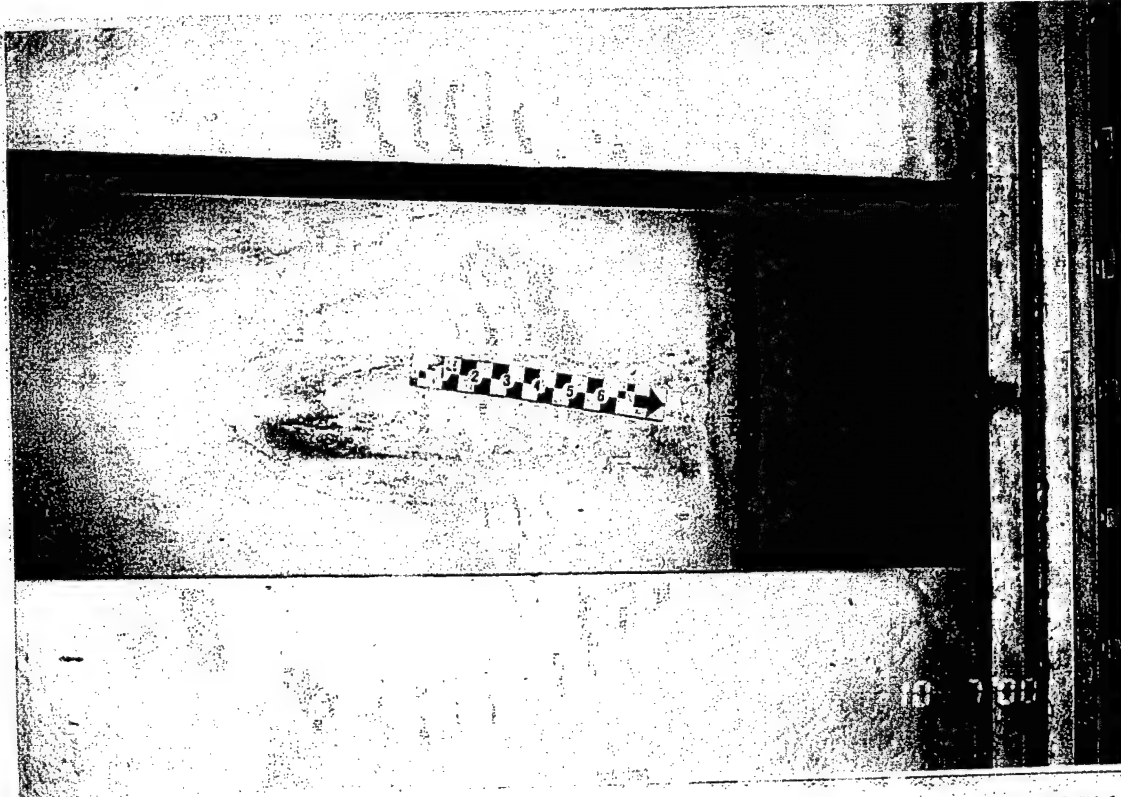
Lower  
Granite  
Dam

10/07/00

4-12

**Gate 4**

Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.



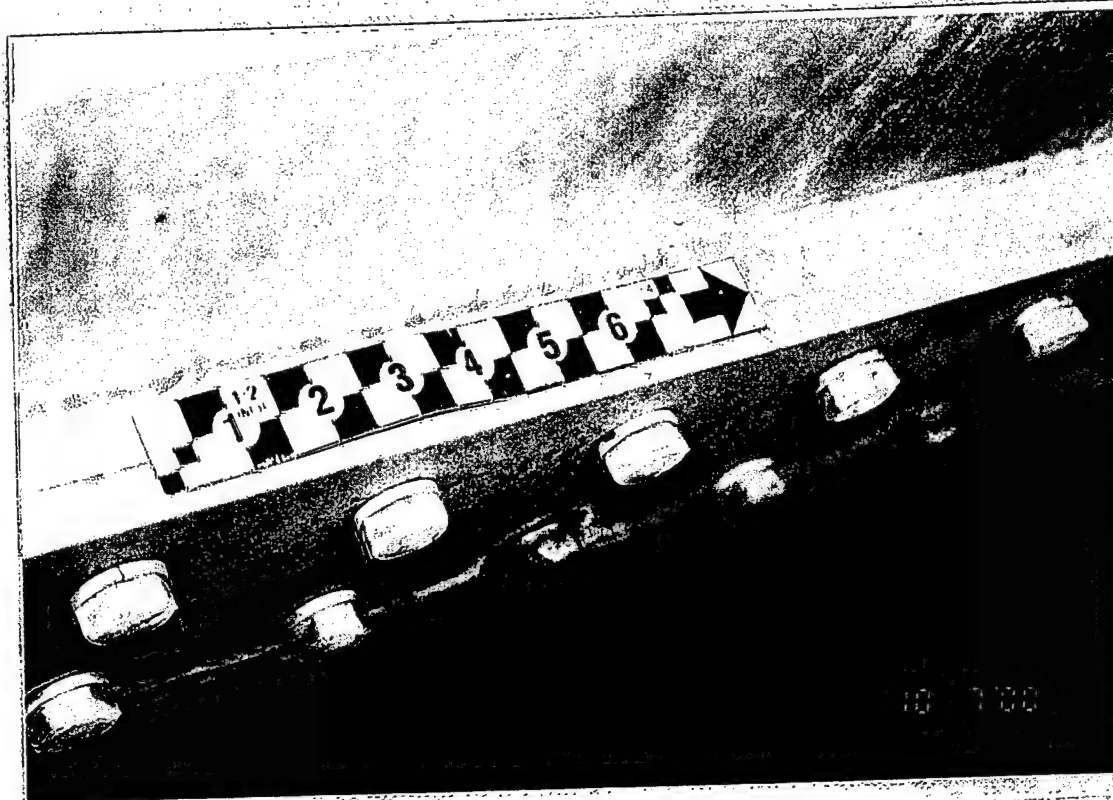
Lower  
Granite  
Dam

10/07/00

4-13

#### Gate 4

Bottom seal closure plate looking  
upstream. Standing water between  
closure plate, purlin webs and  
skinplate. Typical.



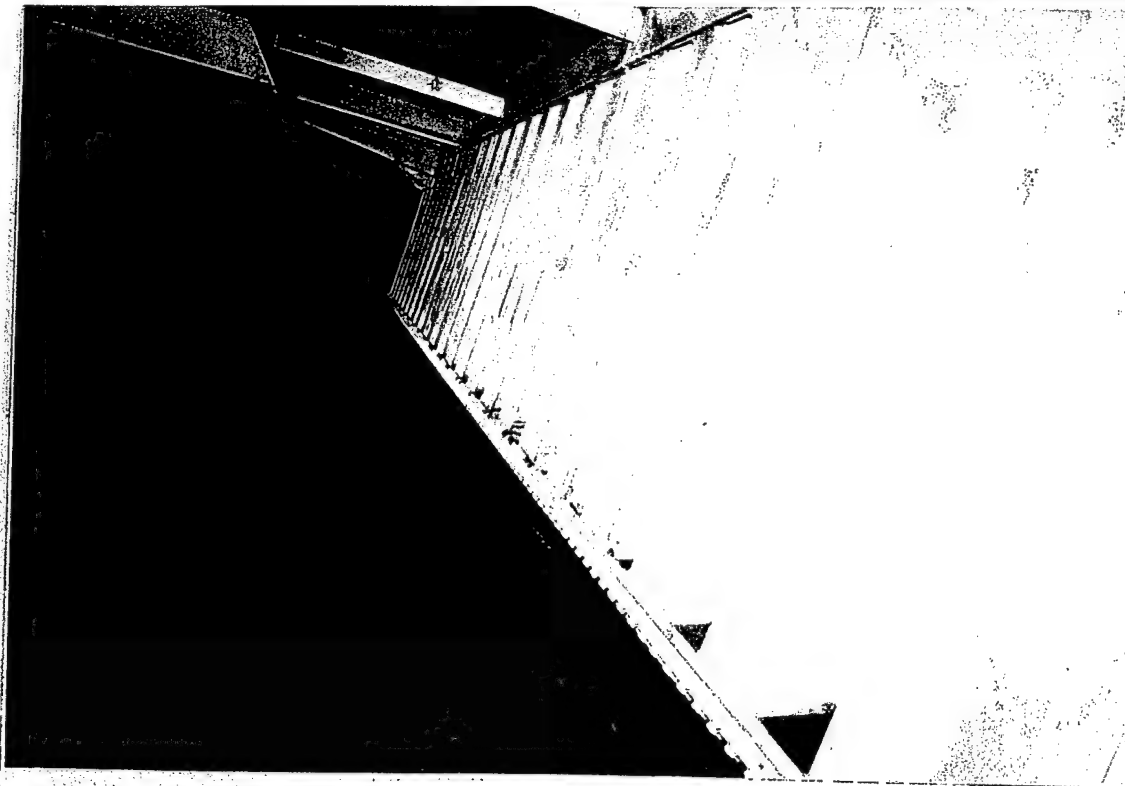
Lower  
Granite  
Dam

10/07/00

4-14

#### Gate 4

Bottom seal and keeper plate,  
looking upstream, typical.



Lower  
Granite  
Dam

10/07/00

4-15

Gate 4

Bottom of downstream side of gate,  
typical.



Lower  
Granite  
Dam

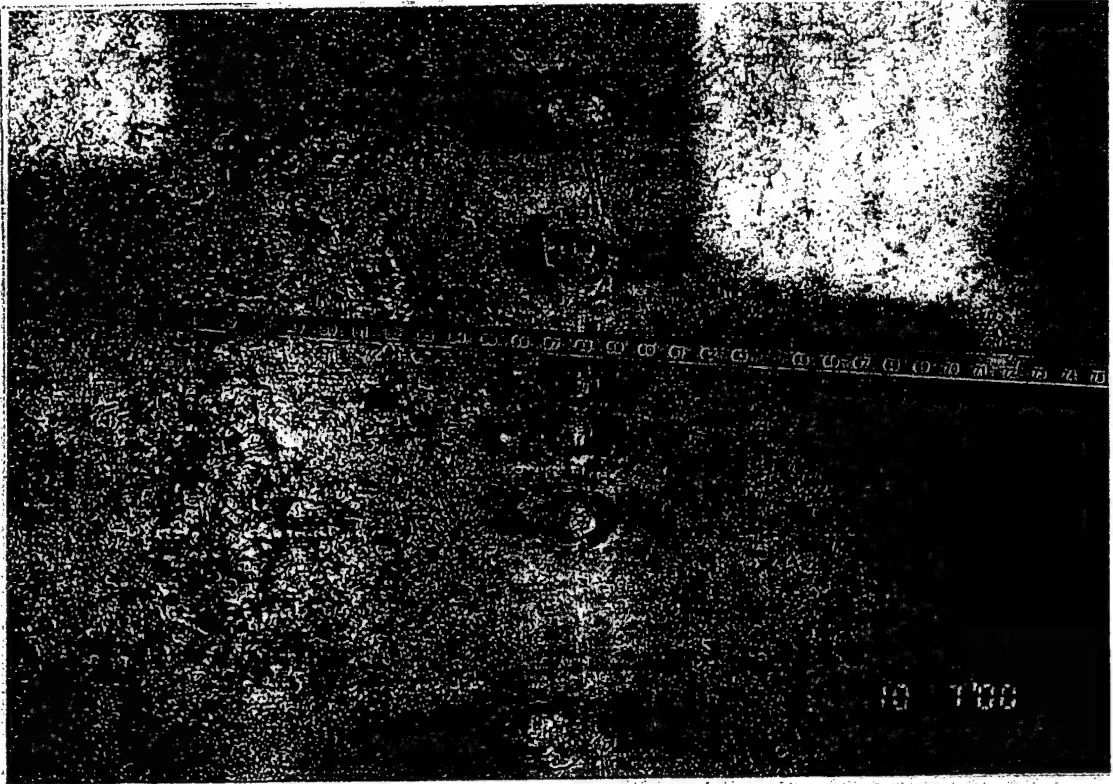
10/07/00

4-16

Gate 4

Waterblasting of skinplate.  
Distribution of pitting, typical.





Lower  
Granite  
Dam

Gate 4  
Skin plate pitting, typical.

10/07/00

4-17



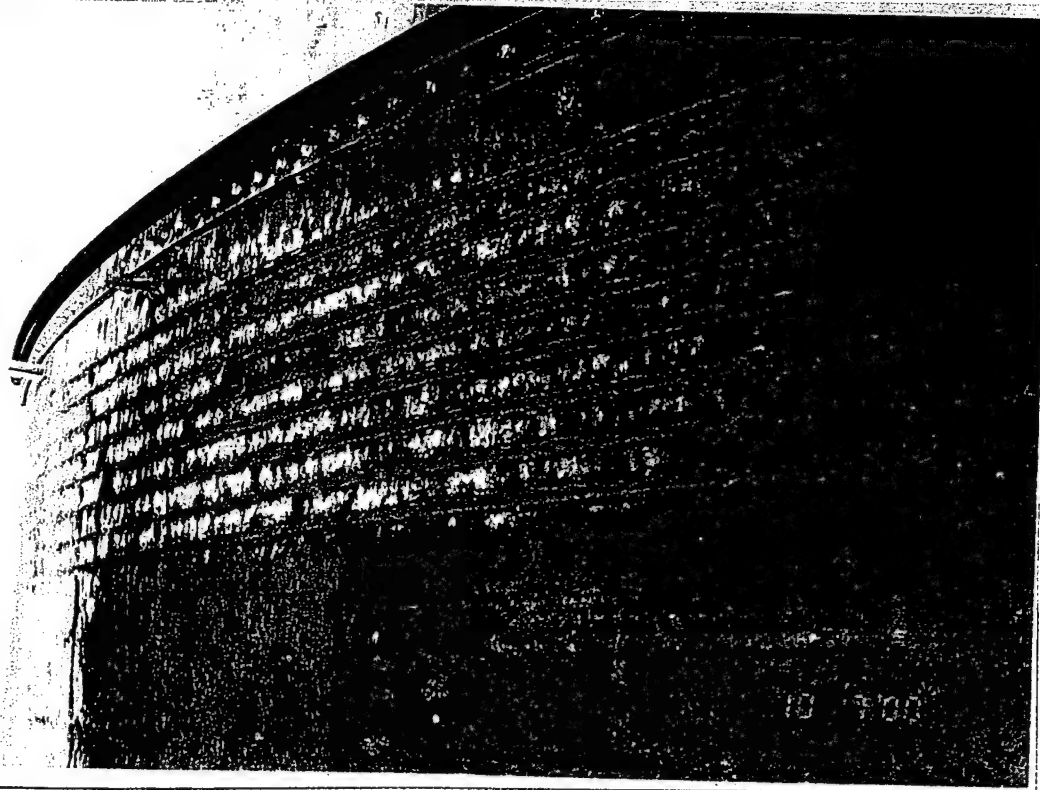
Lower  
Granite  
Dam

Gate 4  
Skin plate pitting, typical.

10/07/00

4-18





Lower  
Granite  
Dam

10/07/00

4-19

**Gate 4**

Typical wear plate condition. Light  
grooves due to cable wear, light to  
moderate corrosion.



Lower  
Granite  
Dam

10/08/00

5-1

#### Gate 5

Right frame, upstream end of top  
radial strut. Delaminated paint and  
light corrosion on web.



Lower  
Granite  
Dam

10/08/00

5-2

#### Gate 5

Side seal leak, right side of gate.



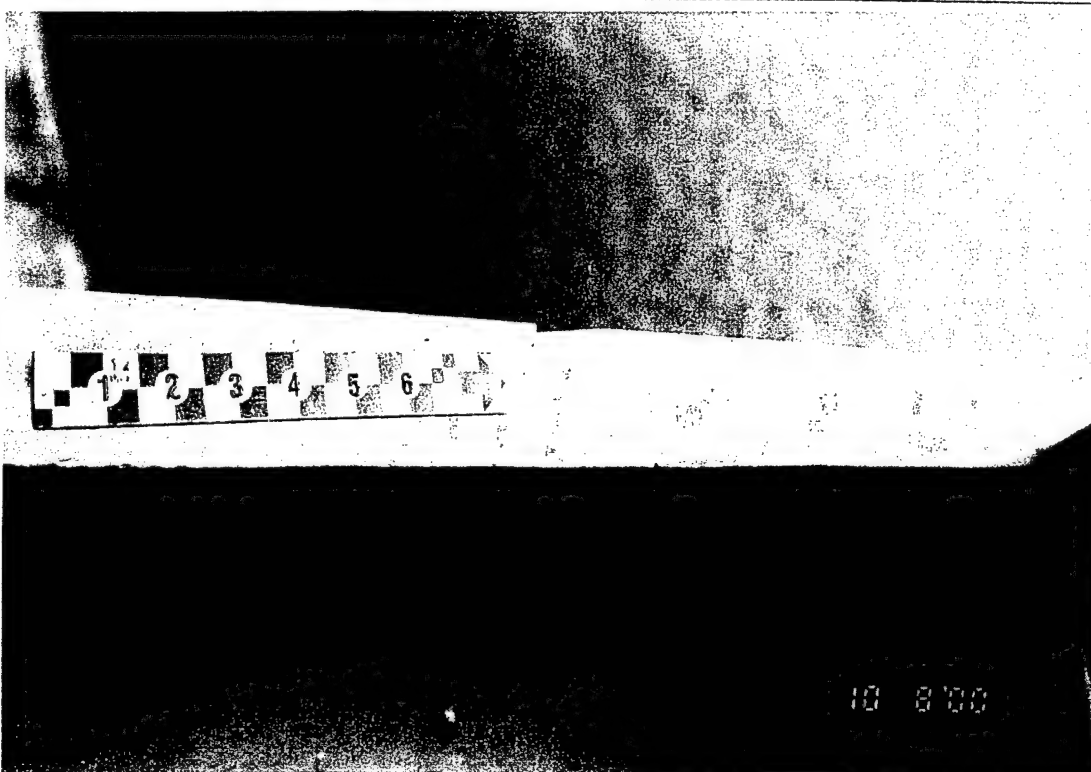
Lower  
Granite  
Dam

10/08/00

5-3

**Gate 5**

Right end of middle horizontal girder.  
Light corrosion due to side seal leak.



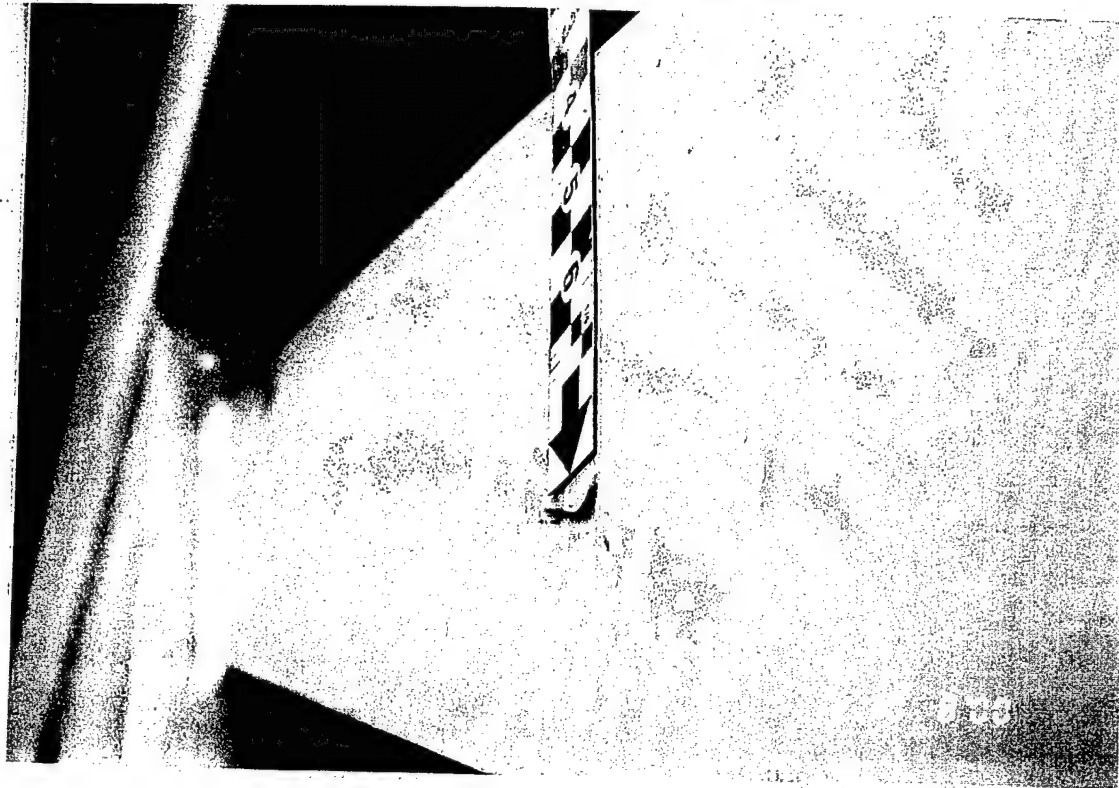
Lower  
Granite  
Dam

10/08/00

5-4

**Gate 5**

Right frame, middle radial strut,  
between braces G and E. Small  
deformation on top, inside flange.

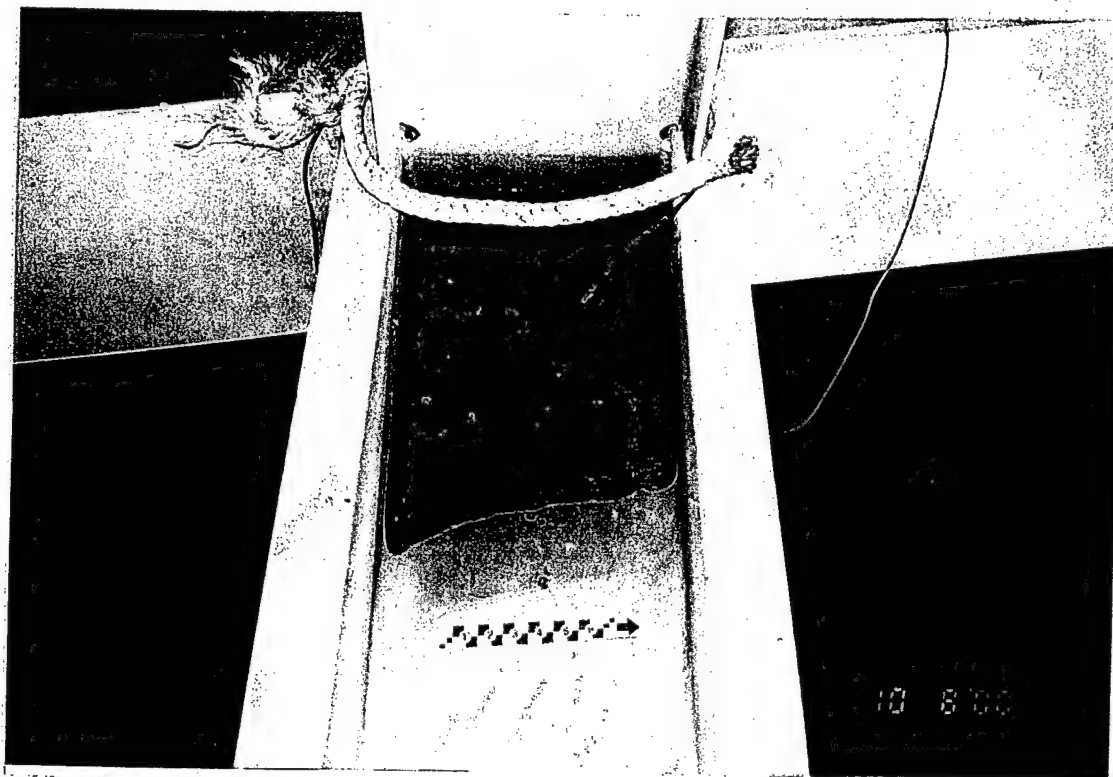


Lower  
Granite  
Dam

10/08/00

5-5

**Gate 5**  
Right frame, Brace H. Small  
deformation on inside flange.



Lower  
Granite  
Dam

10/08/00

5-6

**Gate 5**  
Right frame, upstream end of bottom  
radial strut. Ponding due to  
inadequate drainage.



Lower  
Granite  
Dam

10/08/00

5-7

#### Gate 5

Right end of bottom horizontal girder.  
Standing water, no drainage between  
multiple stiffeners. Horizontal girder  
to skin plate stiffeners, standing  
water, debris and no drainage



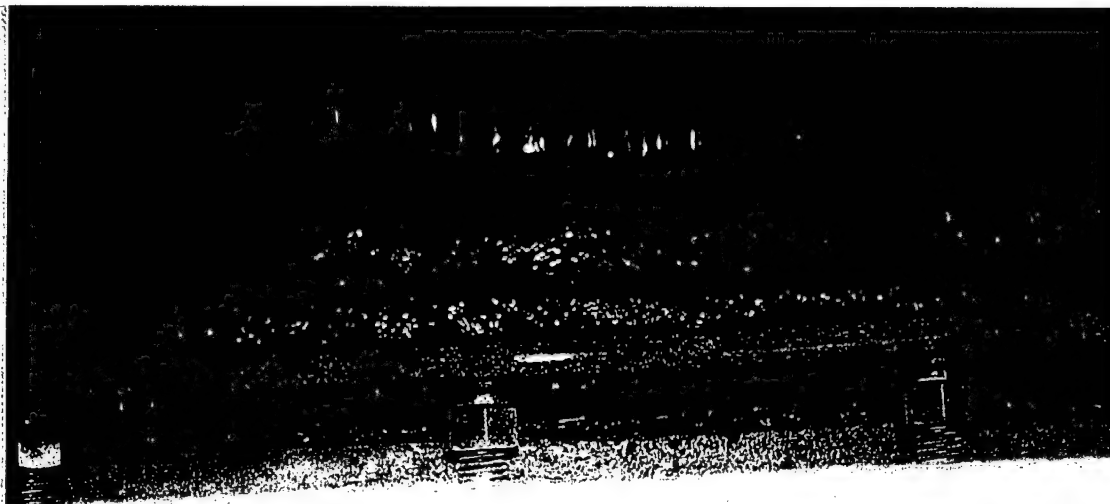
Lower  
Granite  
Dam

10/08/00

5-8

#### Gate 5

Left end of bottom horizontal girder.  
Standing water, inadequate drainage  
between stiffeners.

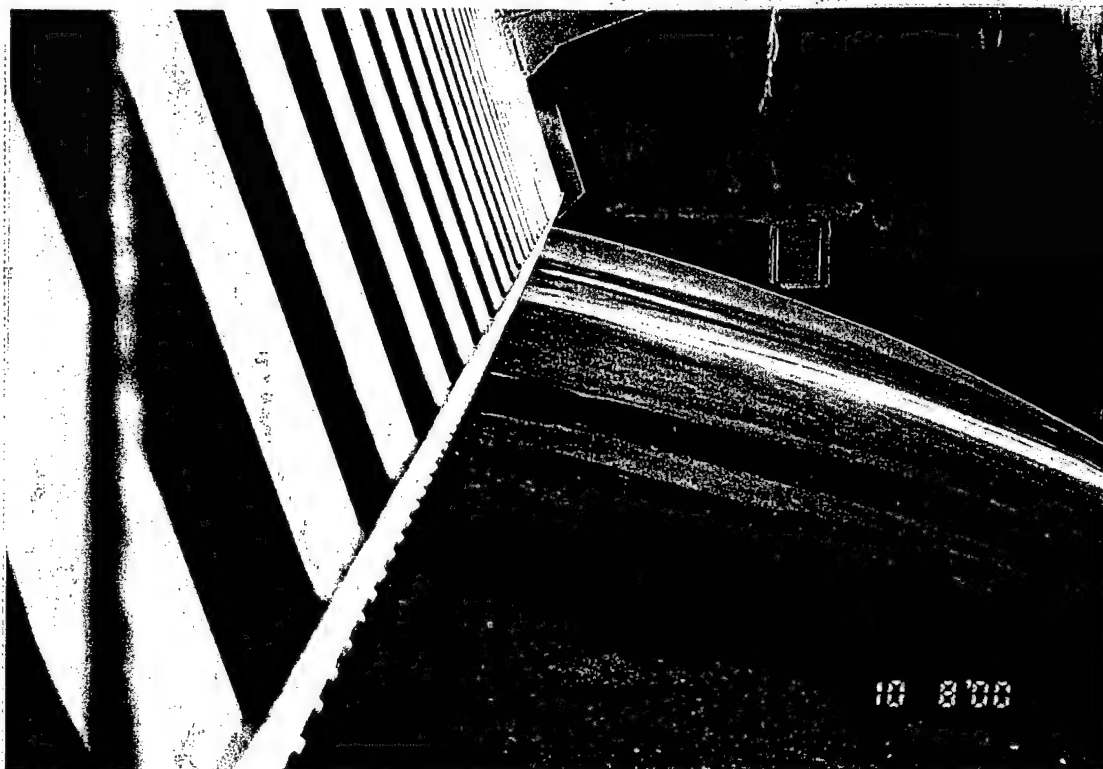


Lower  
Granite  
Dam

Gate 5  
Side seal, typical.

10/08/00

5-9



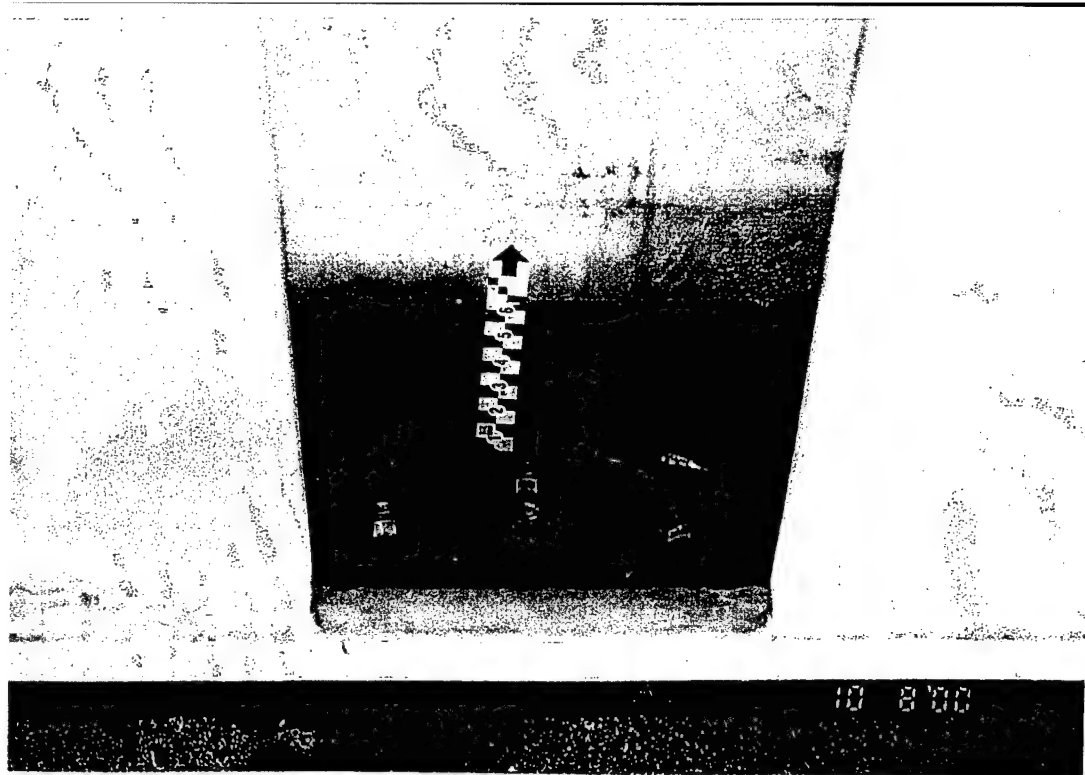
Lower  
Granite  
Dam

Gate 5  
Bottom of gate at spillway, typical.

10/08/00

5-10





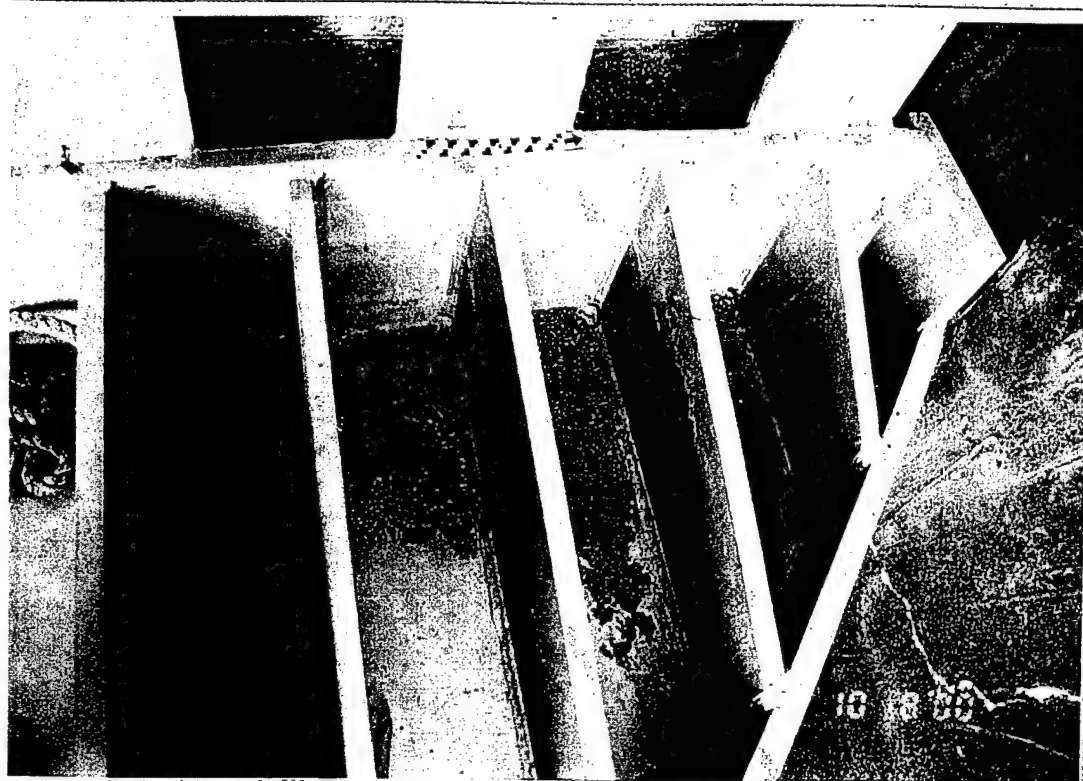
Lower  
Granite  
Dam

10/08/00

5-11

#### Gate 5

Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate. Typical.



Lower  
Granite  
Dam

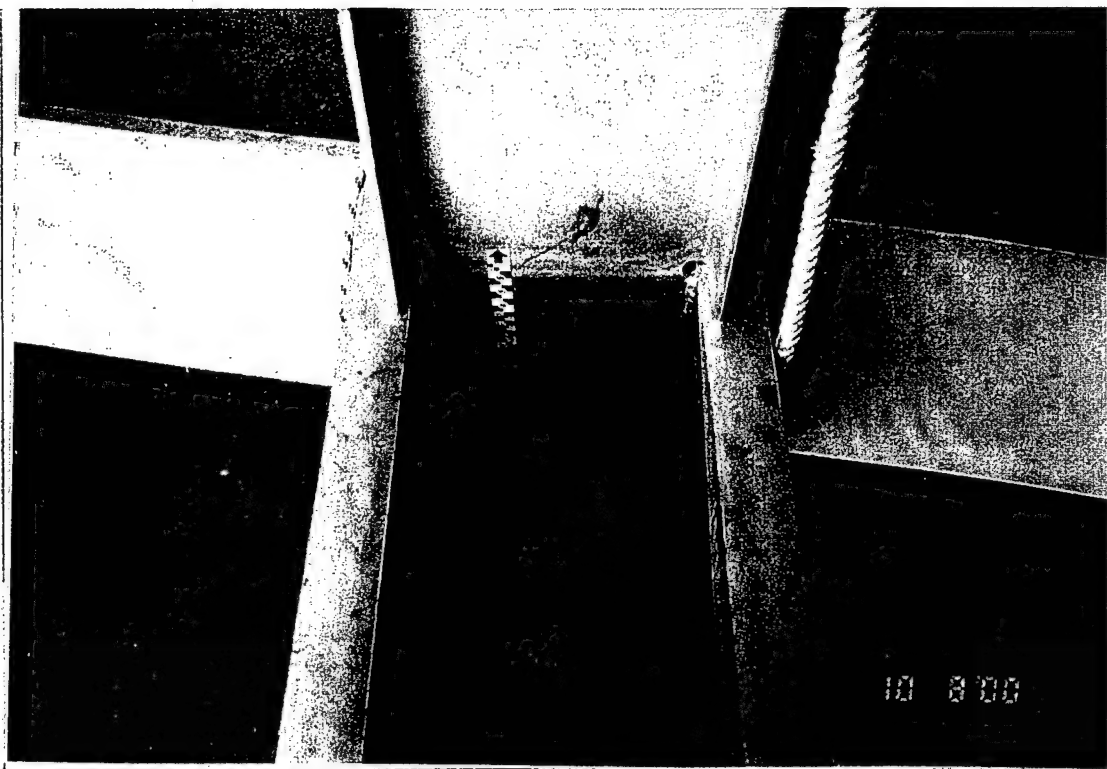
10/08/00

5-12

#### Gate 5

Left end of bottom horizontal girder. Evidence of standing water, no drainage between multiple stiffeners.





Lower  
Granite  
Dam

10/08/00

5-13

#### Gate 5

Left frame, upstream end of bottom  
radial strut. Ponding due to  
inadequate drainage.



Lower  
Granite  
Dam

10/06/00

5-14

#### Gate 5

Waterblasting upstream surface of  
skin plate.



Lower  
Granite  
Dam

10/06/00

5-15

Gate 5

Skin plate pitting, typical.



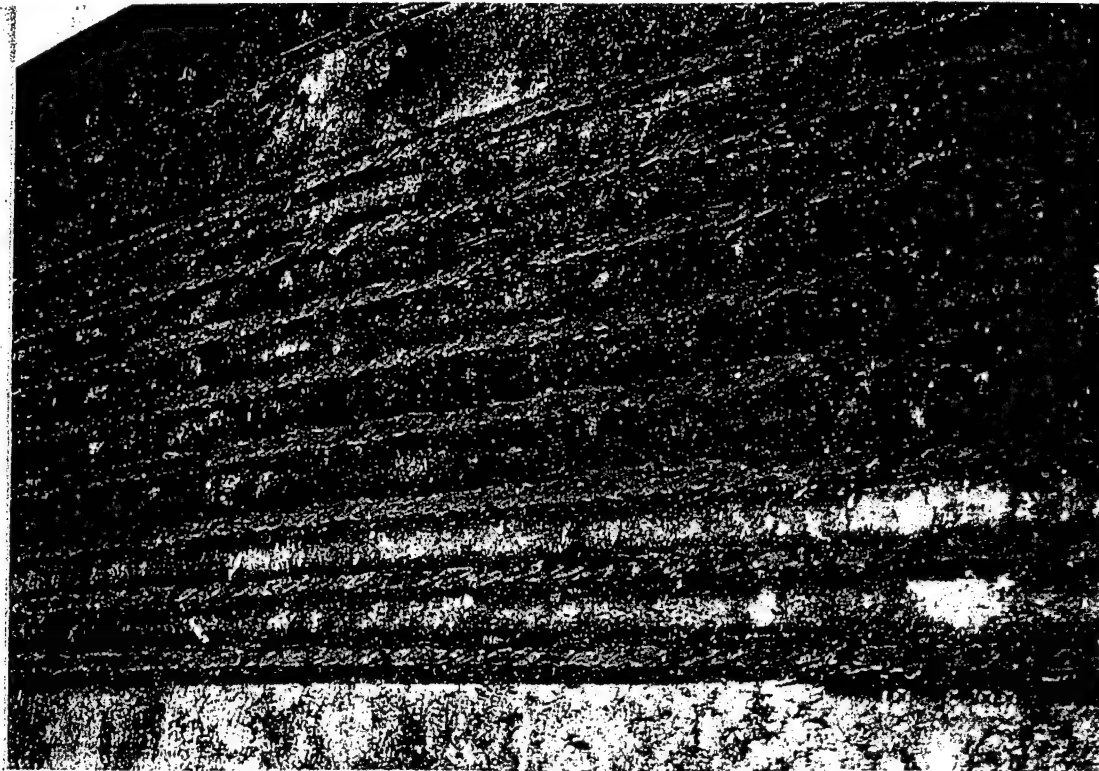
Lower  
Granite  
Dam

10/06/00

5-16

Gate 5

Skin plate pitting, typical.



Lower  
Granite  
Dam

10/06/00

5-17

#### Gate 5

Typical wear plate condition. Light grooves due to cable wear, light to moderate corrosion.



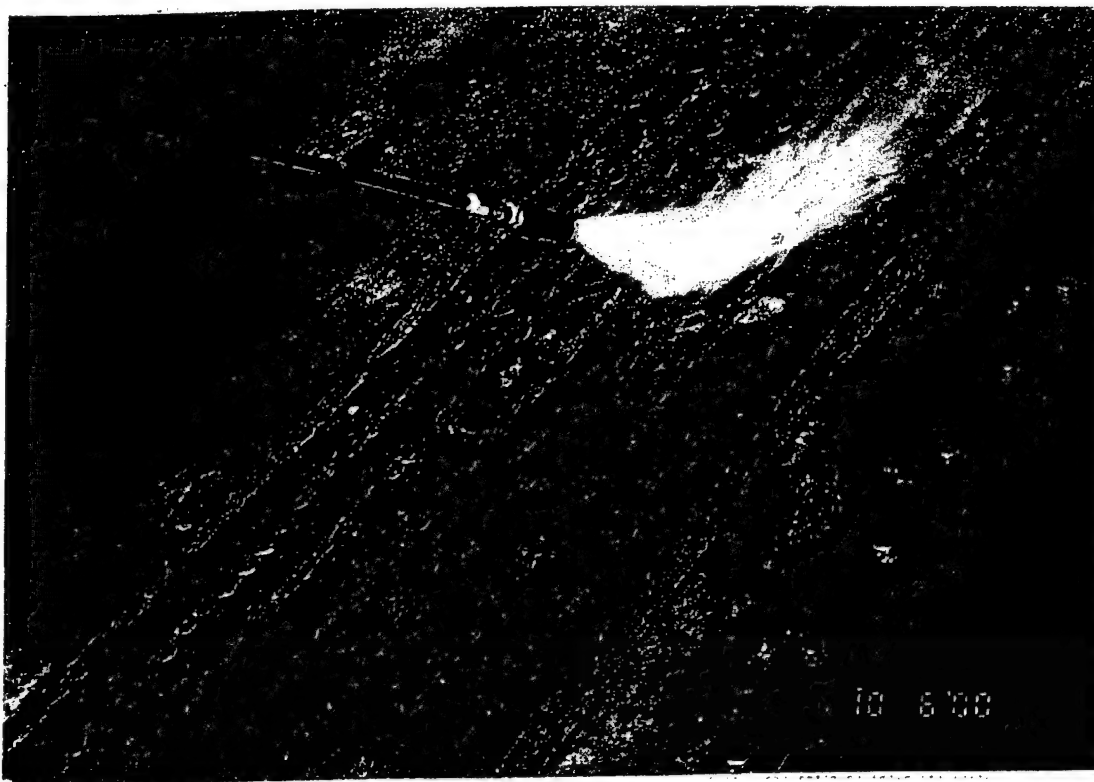
Lower  
Granite  
Dam

10/06/00

5-18

#### Gate 5

Skin plate pitting apparently associated with scratches in protective coating.



10 8'00

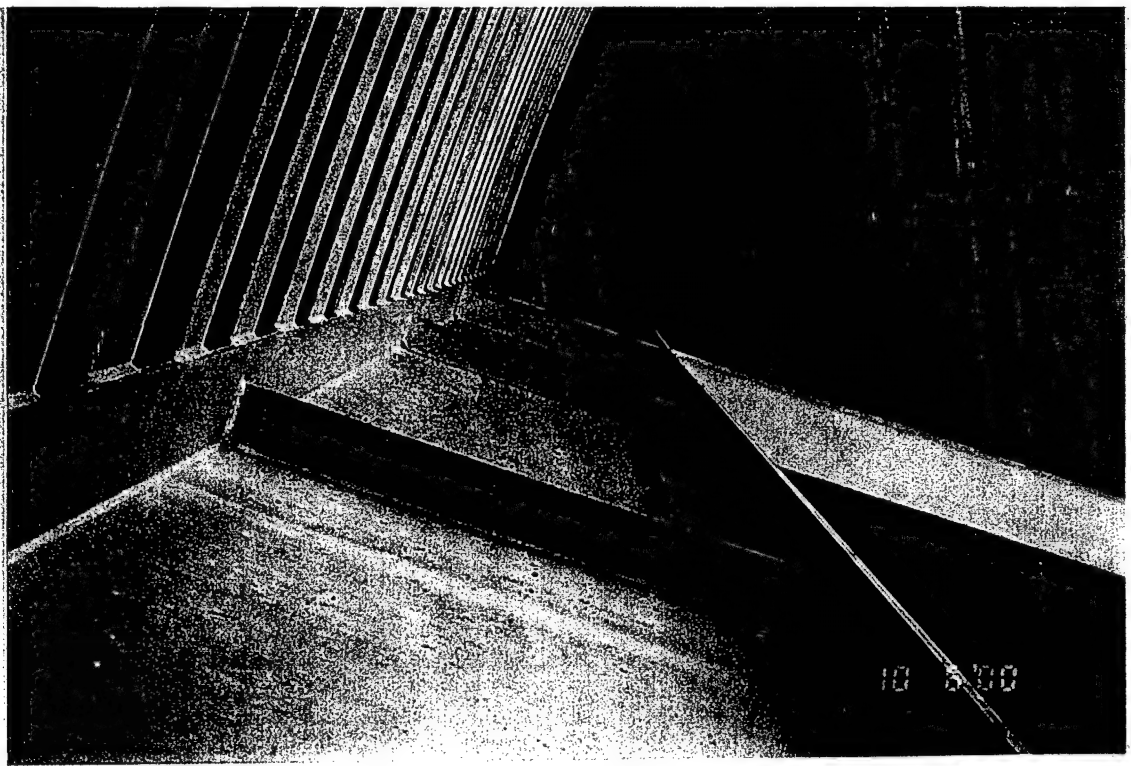
Lower  
Granite  
Dam

10/06/00

5-19

**Gate 5**

Typical wear plate condition. Light grooves due to cable wear, light to moderate corrosion.

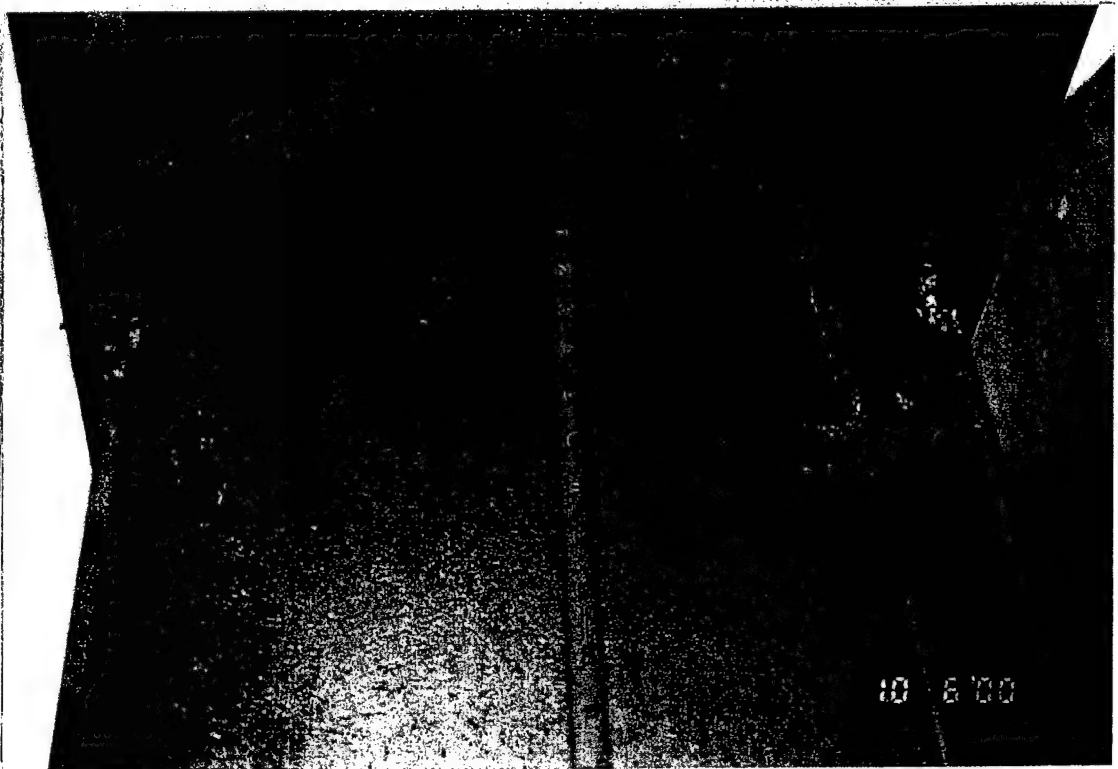


Lower  
Granite  
Dam

Gate 6  
Top horizontal girder looking toward  
left frame, typical

10/06/00

6-1

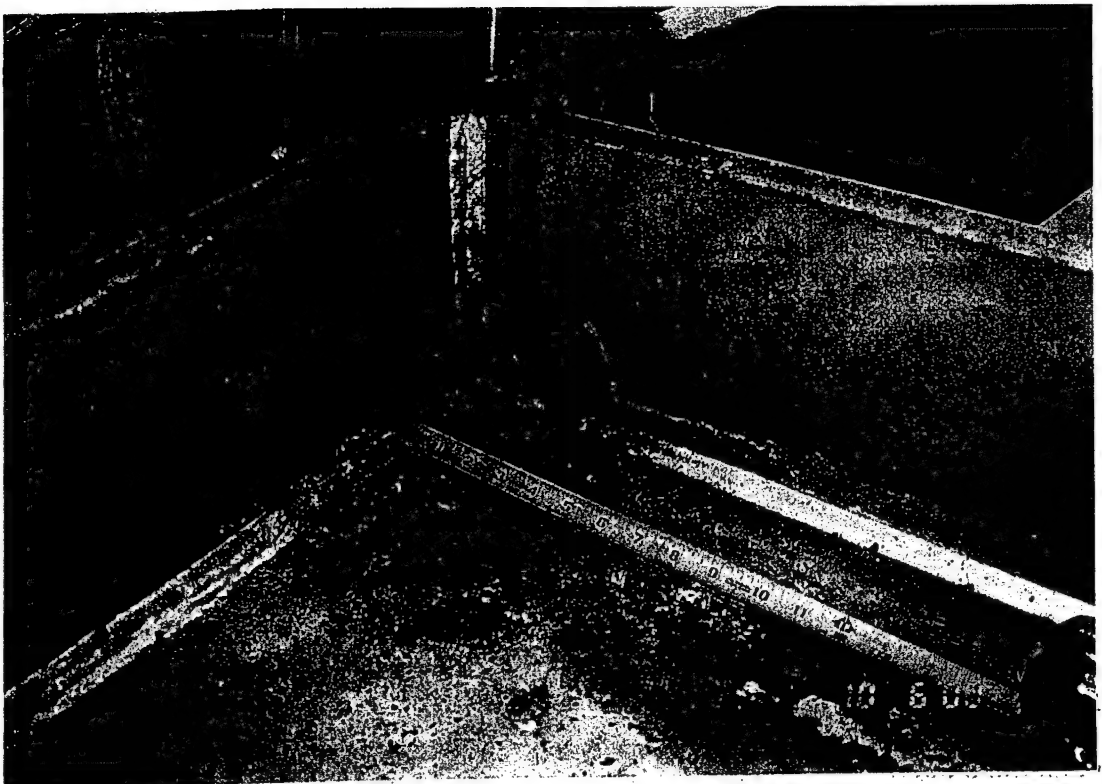


Lower  
Granite  
Dam

Gate 6  
Right frame, Brace C. Coping in  
brace at weld to top radial strut.

10/06/00

6-2



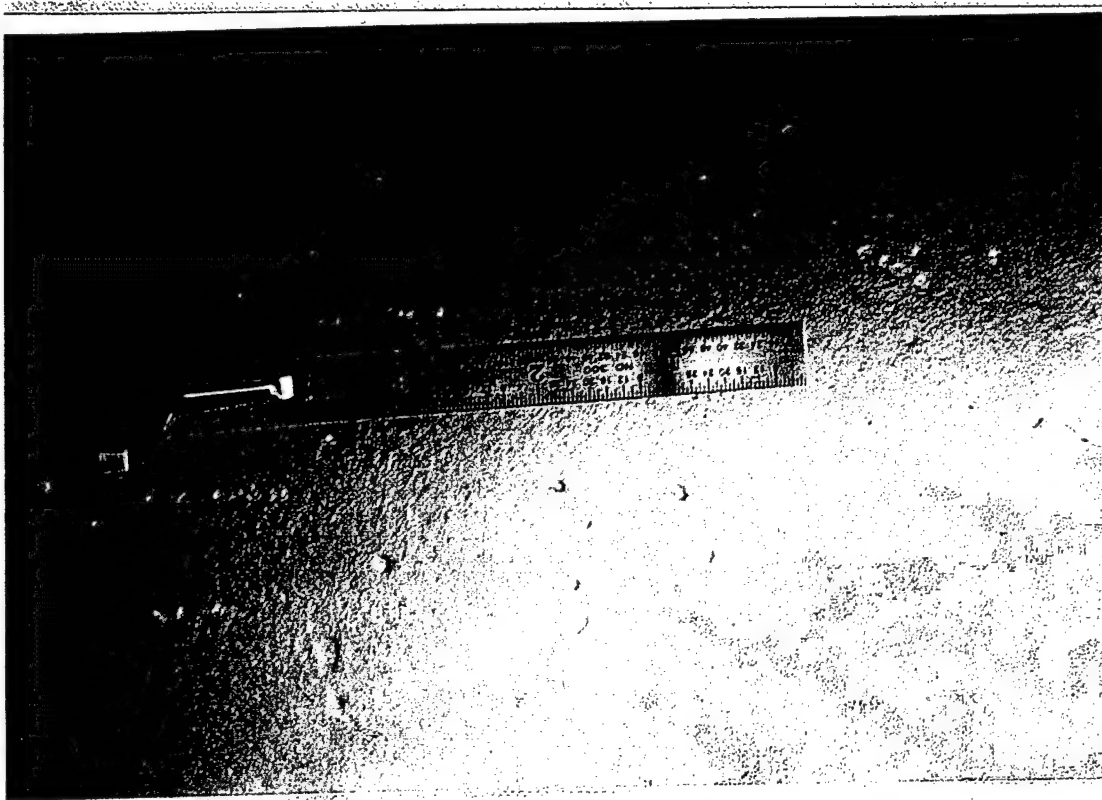
Lower  
Granite  
Dam

10/06/00

6-3

#### Gate 6

Middle horizontal girder, downstream  
flange at connection to radial strut.  
Light corrosion on girder flange.



Lower  
Granite  
Dam

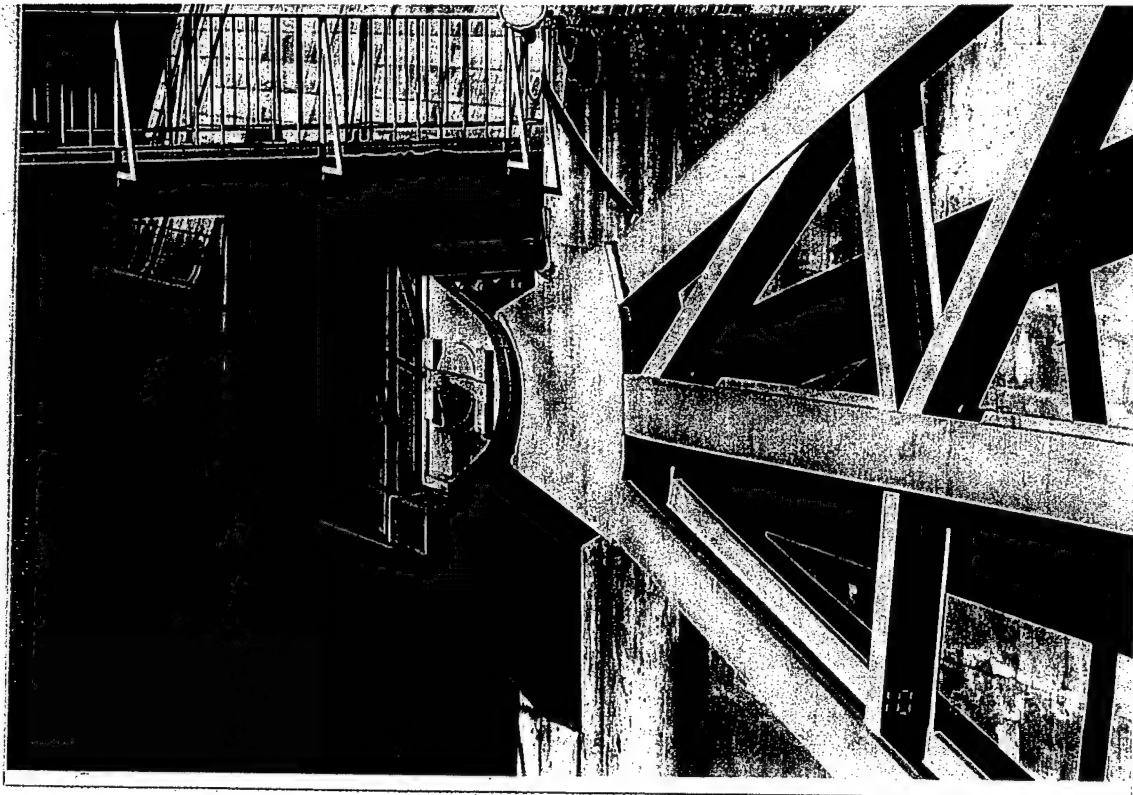
10/06/00

6-4

#### Gate 6

Downstream surface of skin plate,  
approx 5' above middle horizontal  
girder, near left frame. Small surface  
pitting.



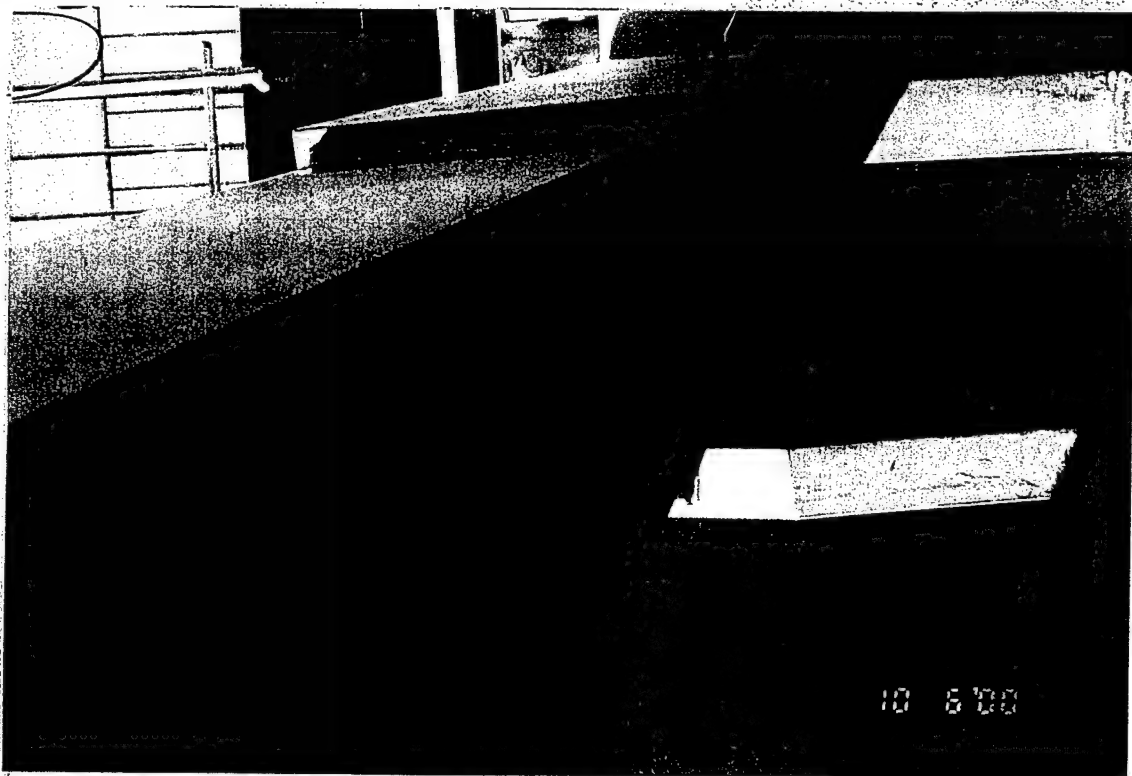


Lower  
Granite  
Dam

Gate 6  
Right frame and trunnion, typical.

10/06/00

6-5



Lower  
Granite  
Dam

Gate 6  
Left frame, inside trunnion closure  
plate, typical.

10/06/00

6-6



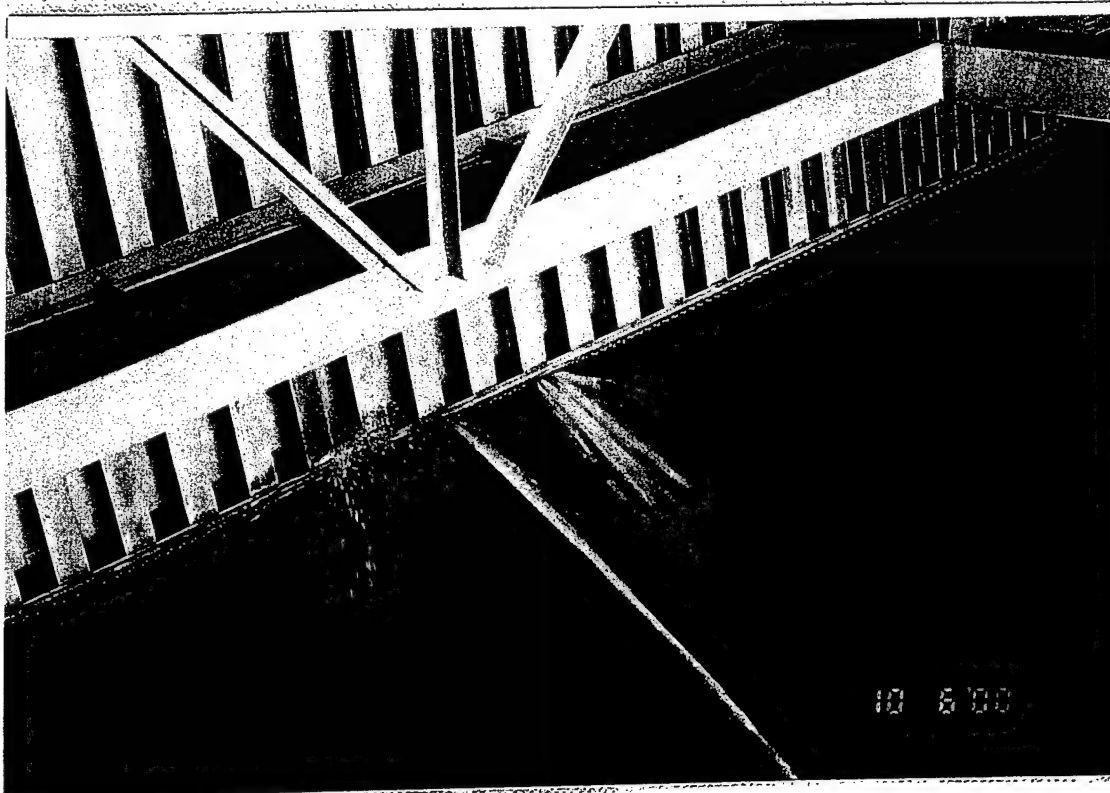


Lower  
Granite  
Dam

10/06/00

6-7

Gate 6  
Outside of right trunnion and yoke.  
Note: Lubrication lines.

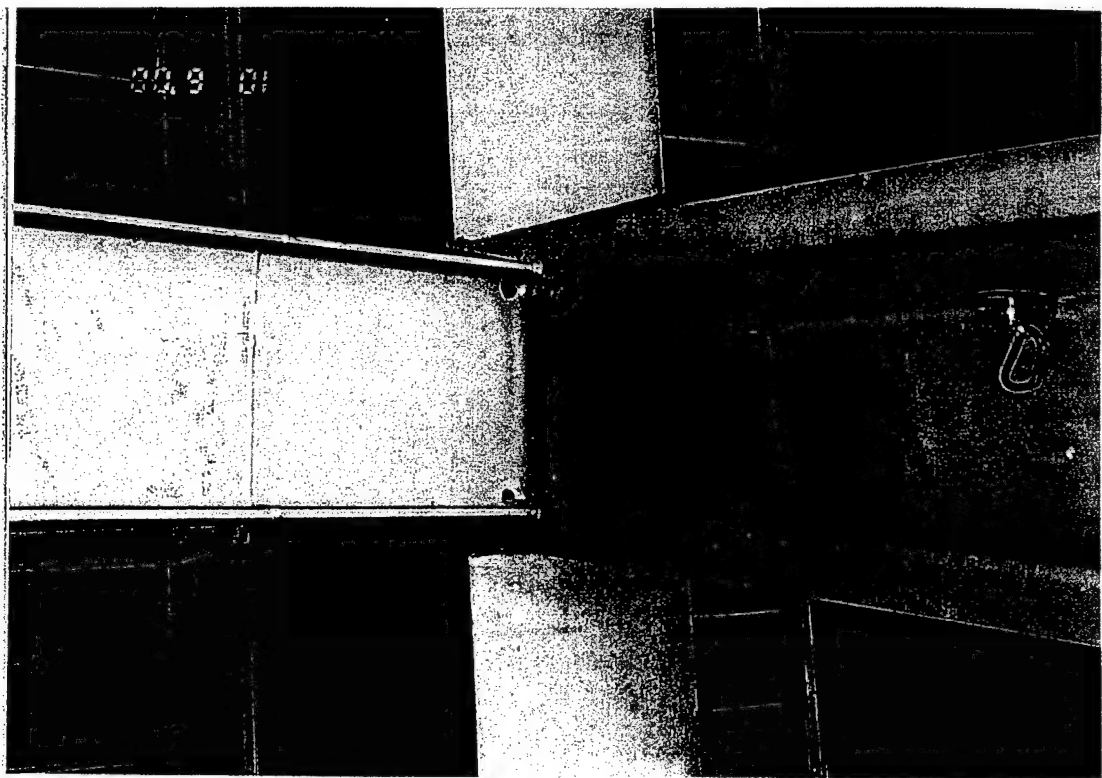


Lower  
Granite  
Dam

10/06/00

6-8

Gate 6  
Leak at center construction joint in  
spillway monolith.



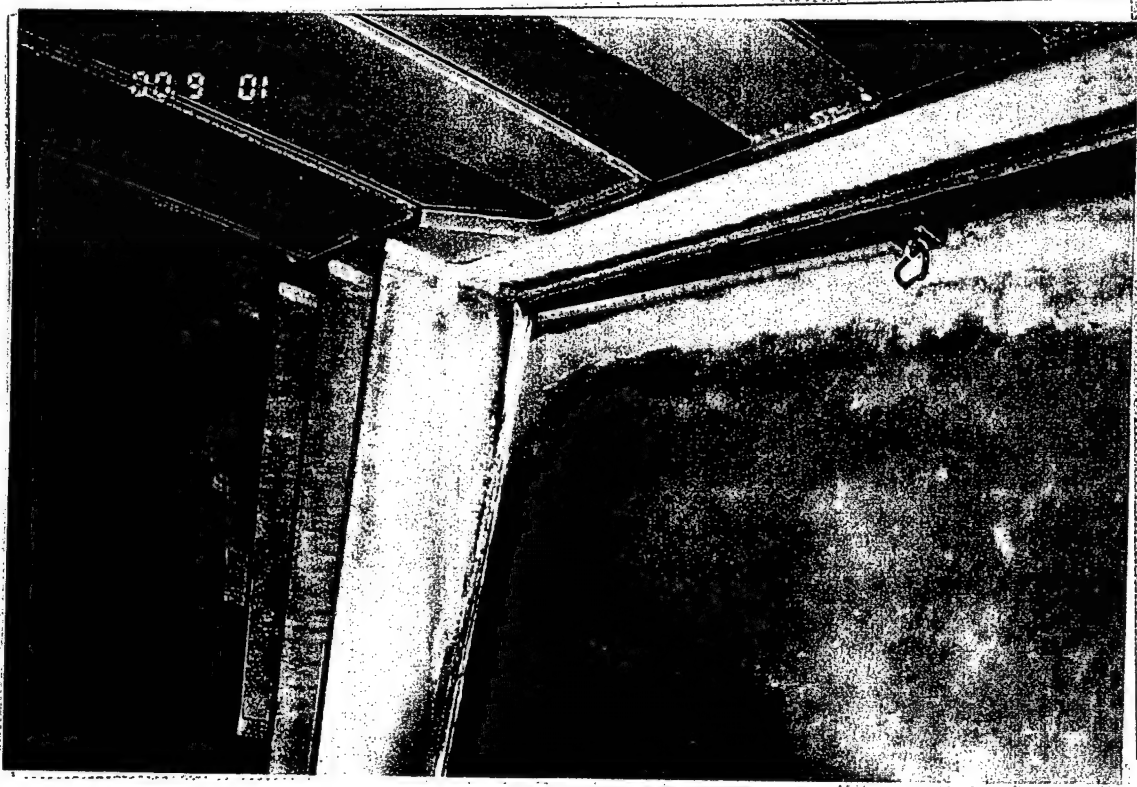
Lower  
Granite  
Dam

10/06/00

6-9

#### Gate 6

Right frame, bottom radial strut.  
Standing water at upstream end of  
strut due to inadequate drainage.



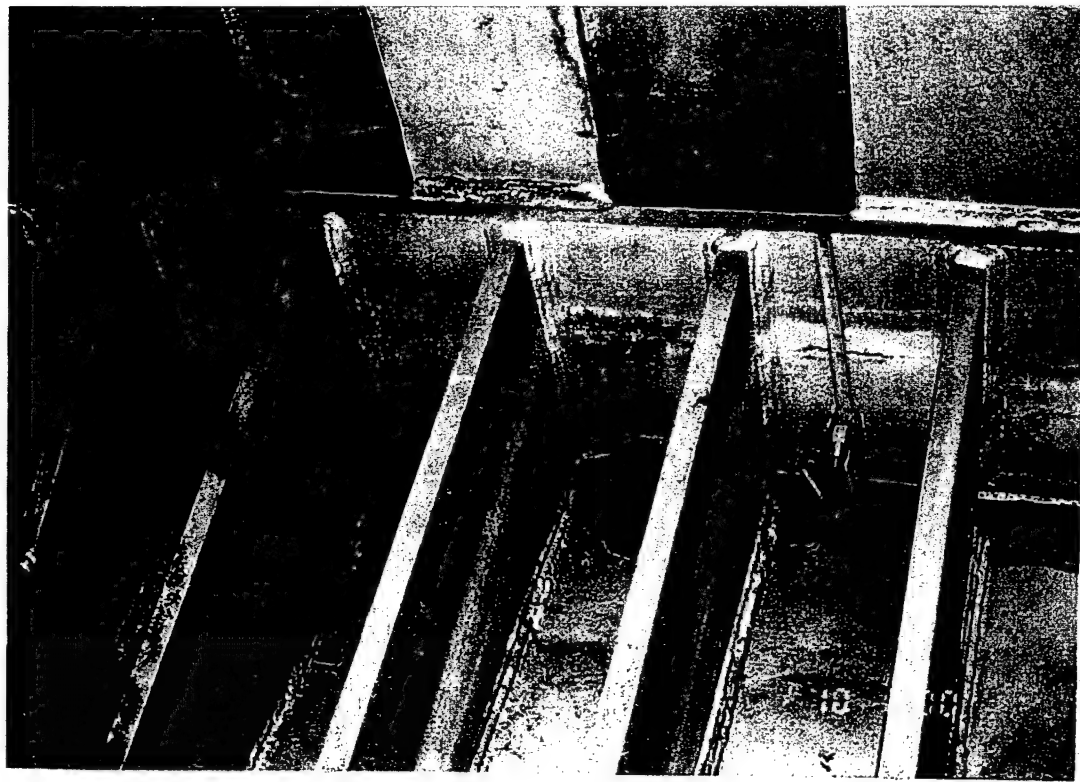
Lower  
Granite  
Dam

10/06/00

6-10

#### Gate 6

Right end of bottom horizontal girder,  
standing water at upstream side of  
girder web and flange.



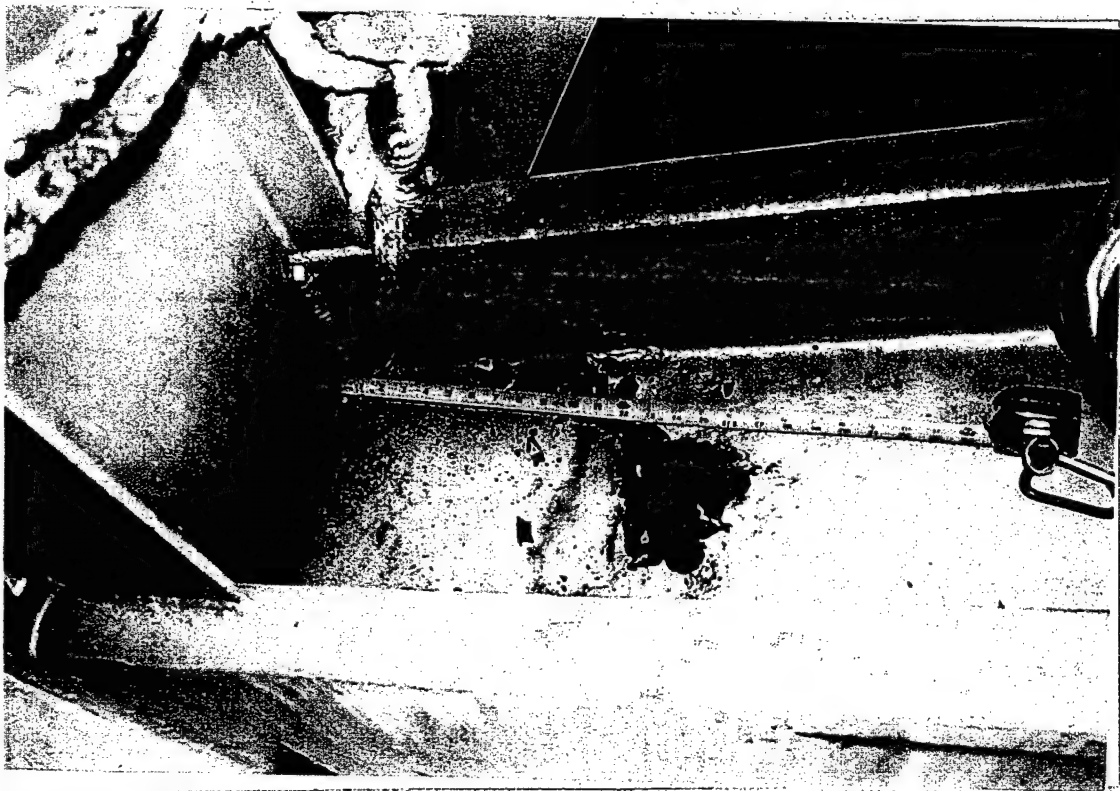
Lower  
Granite  
Dam

10/06/00

6-11

#### Gate 6

Right end of bottom horiz. girder.  
Standing water, no drainage between  
multiple stiffeners. Horizontal girder  
to skin plate stiffeners, standing  
water, debris and no drainage



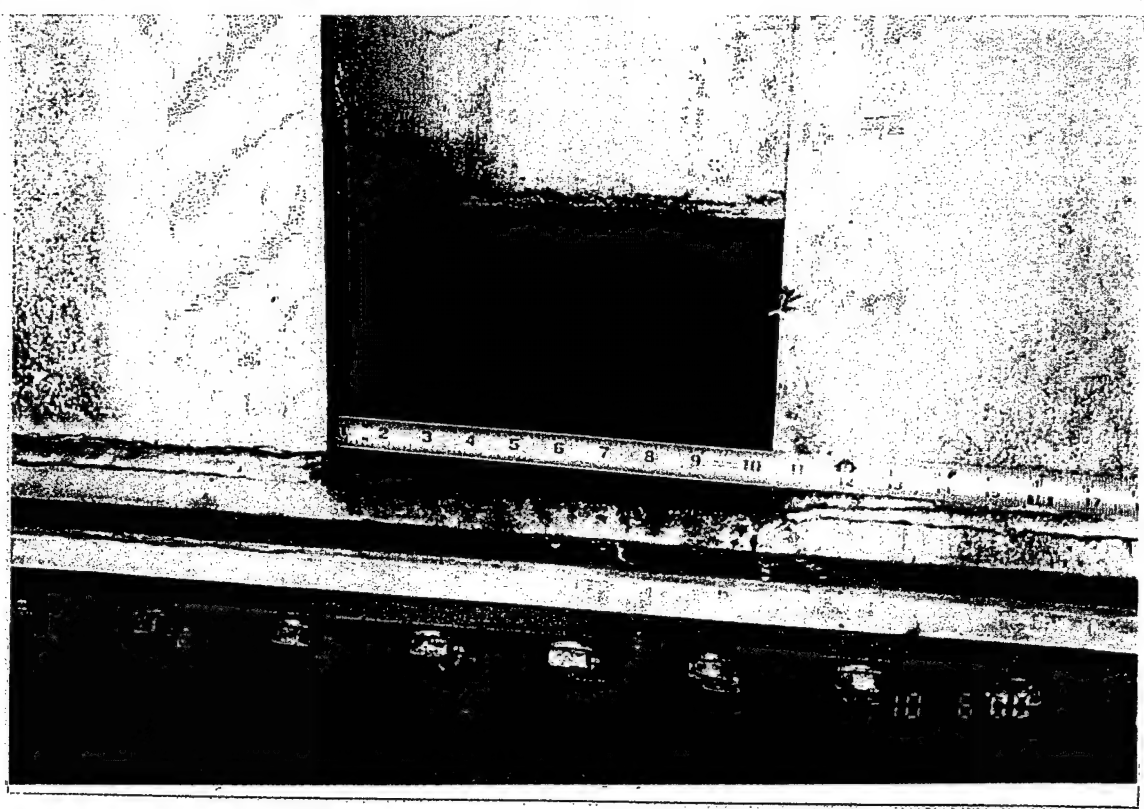
Lower  
Granite  
Dam

10/06/00

6-12

#### Gate 6

Left frame, bottom radial strut.  
Evidence of standing water at  
upstream end of strut due to  
inadequate drainage. Light  
corrosion.



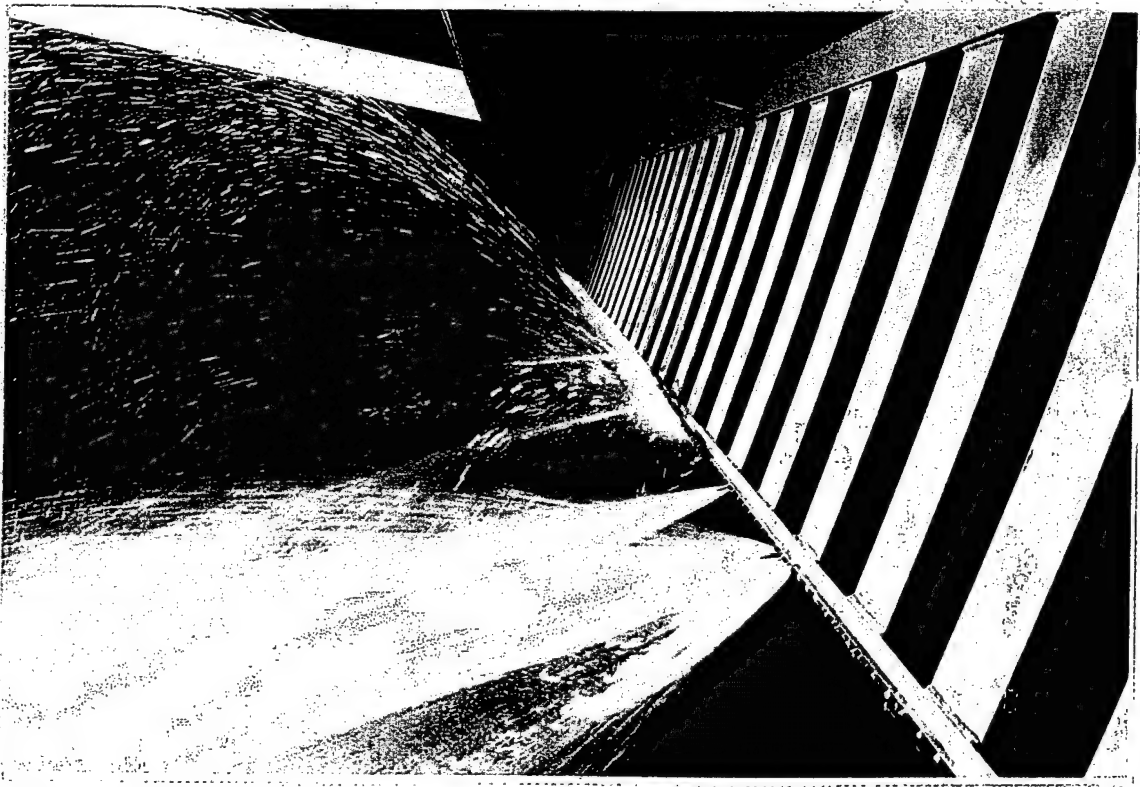
Lower  
Granite  
Dam

10/06/00

6-13

**Gate 6**

Bottom seal closure plate looking  
upstream. Standing water between  
closure plate, purlin webs and  
skinplate, typical.



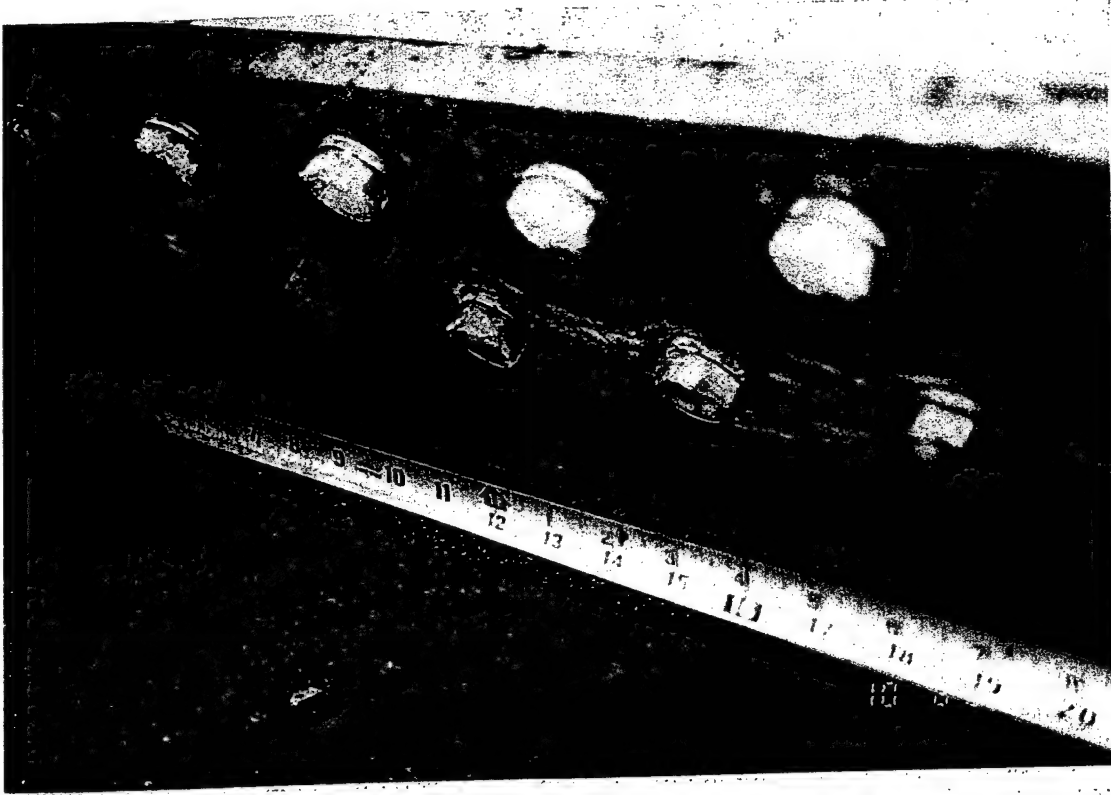
Lower  
Granite  
Dam

10/06/00

6-14

**Gate 6**

Leak at center construction joint in  
spillway monolith, additional bottom  
seal leaks.



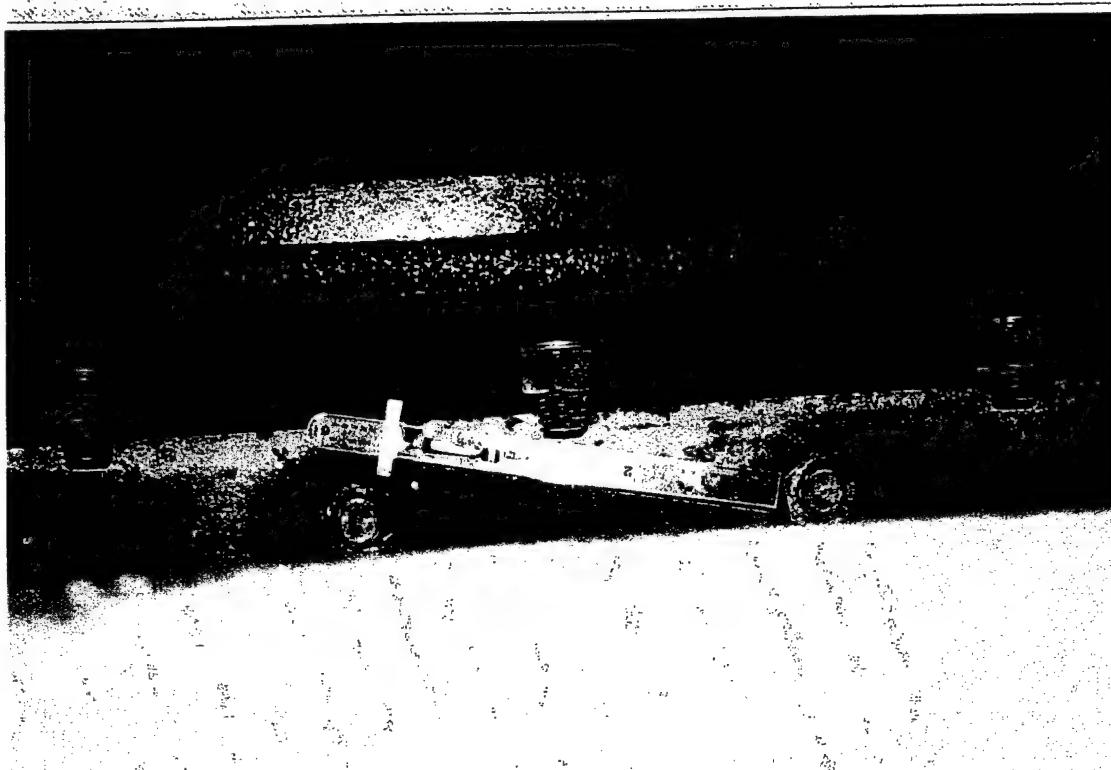
Lower  
Granite  
Dam

10/06/00

6-15

**Gate 6**

Bottom seal keeper plate, looking  
upstream, typical.



Lower  
Granite  
Dam

10/06/00

6-16

**Gate 6**

Side seal, typical.

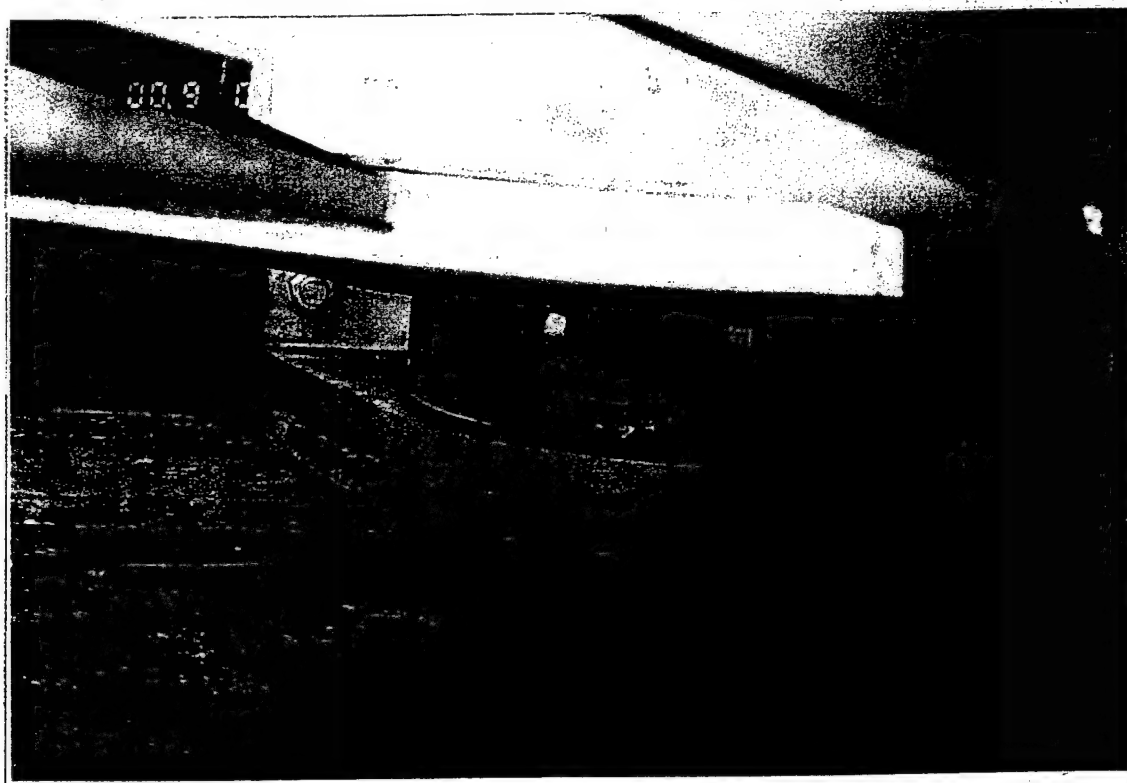


Lower  
Granite  
Dam

Gate 6  
Bottom of left frame horizontal  
girders, typical.

10/06/00

6-17



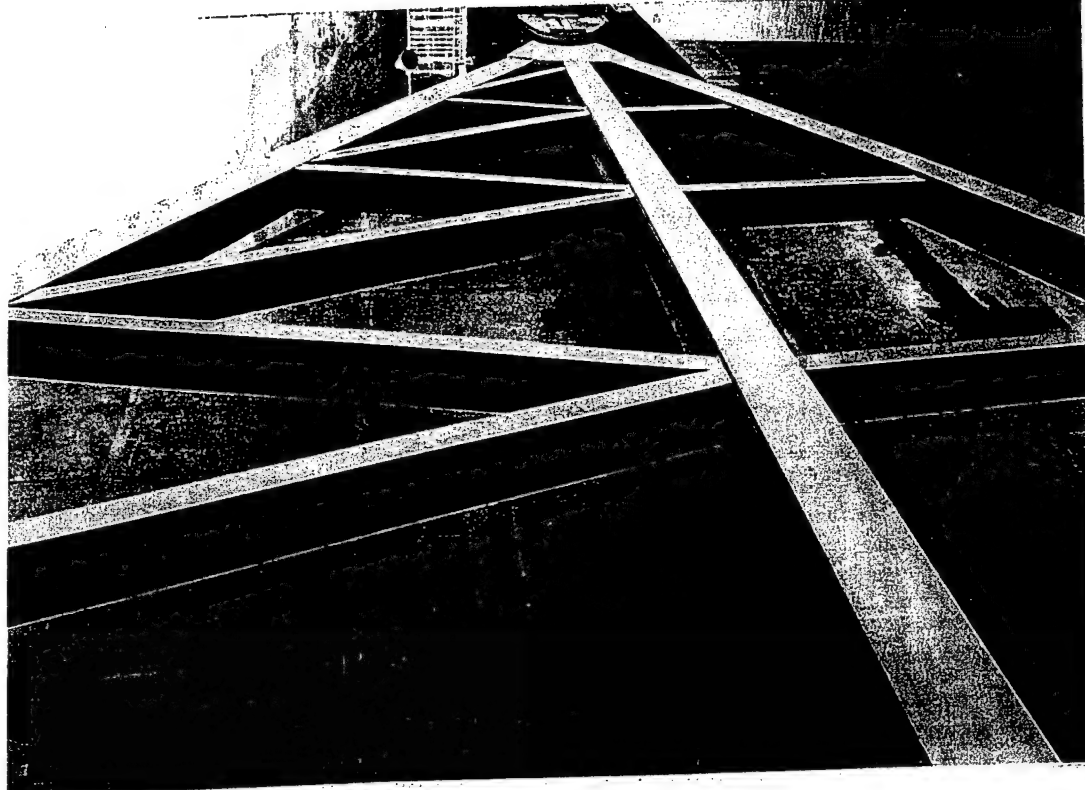
Lower  
Granite  
Dam

Gate 6  
Outside of left trunnion and yoke.  
Note: Lubrication lines and expelled  
lubrication between trunnion and  
yoke.

10/06/00

6-18



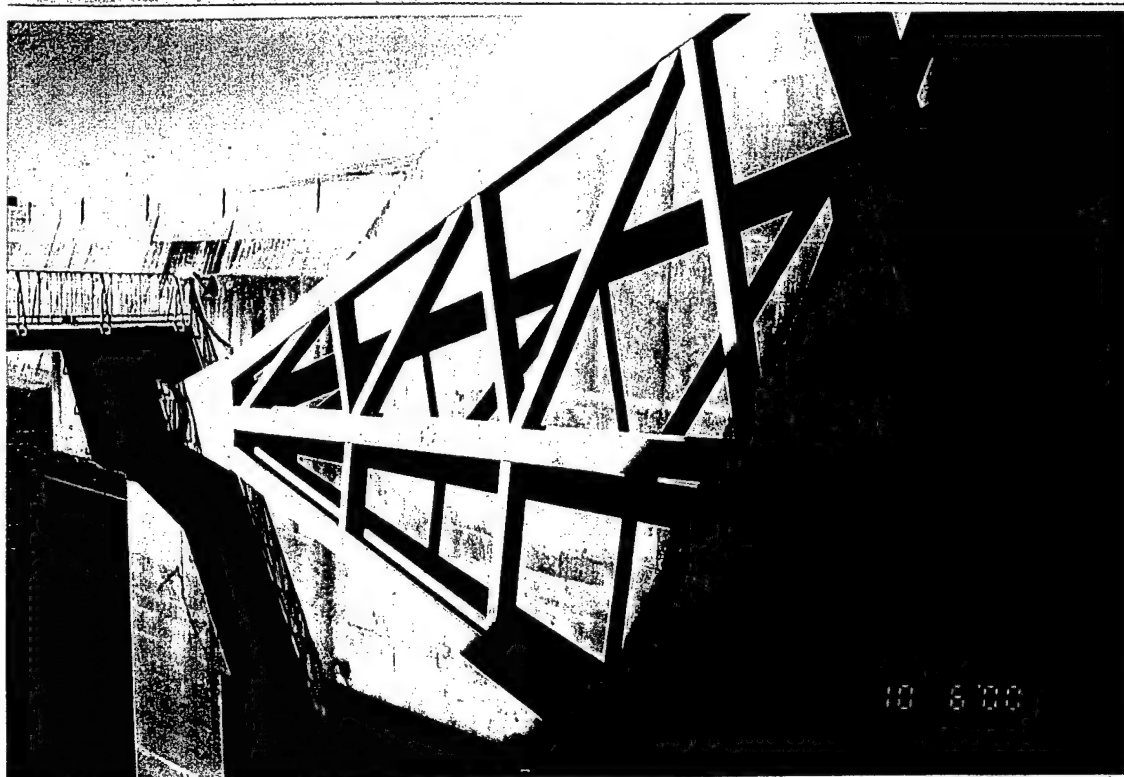


Lower  
Granite  
Dam

Gate 6  
Left frame, typical.

10/06/00

6-19



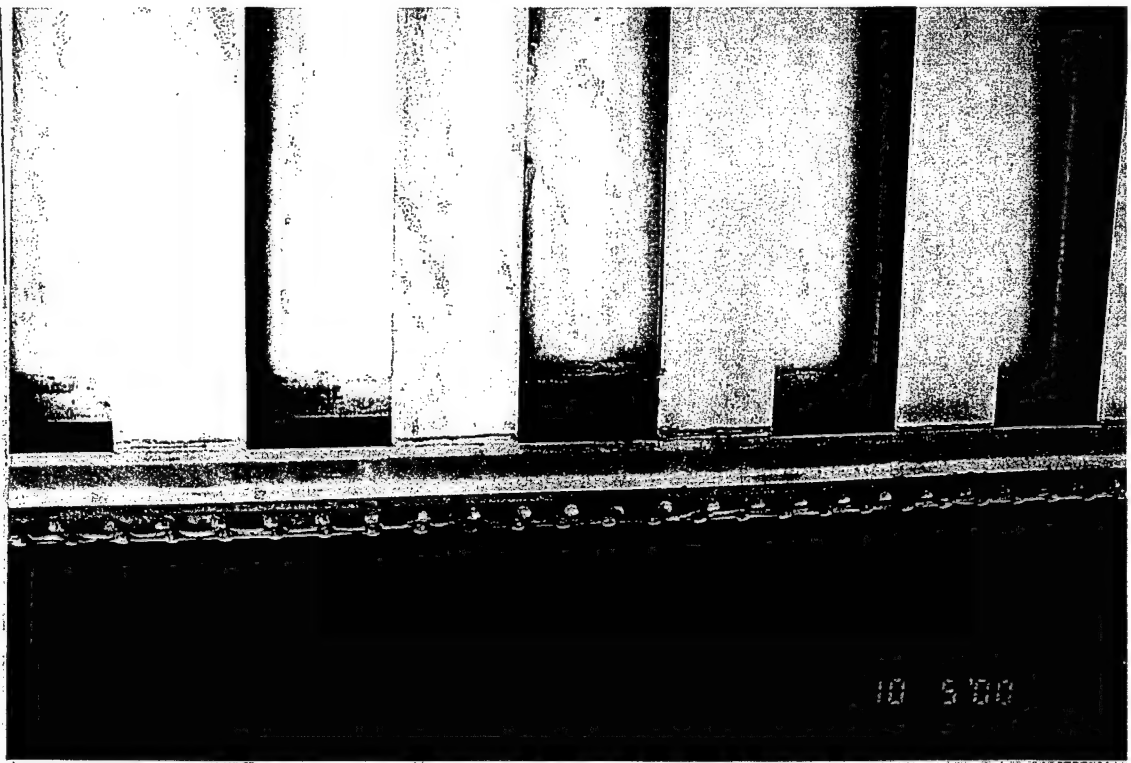
Lower  
Granite  
Dam

Gate 6  
Right frame, typical.

10/06/00

6-20





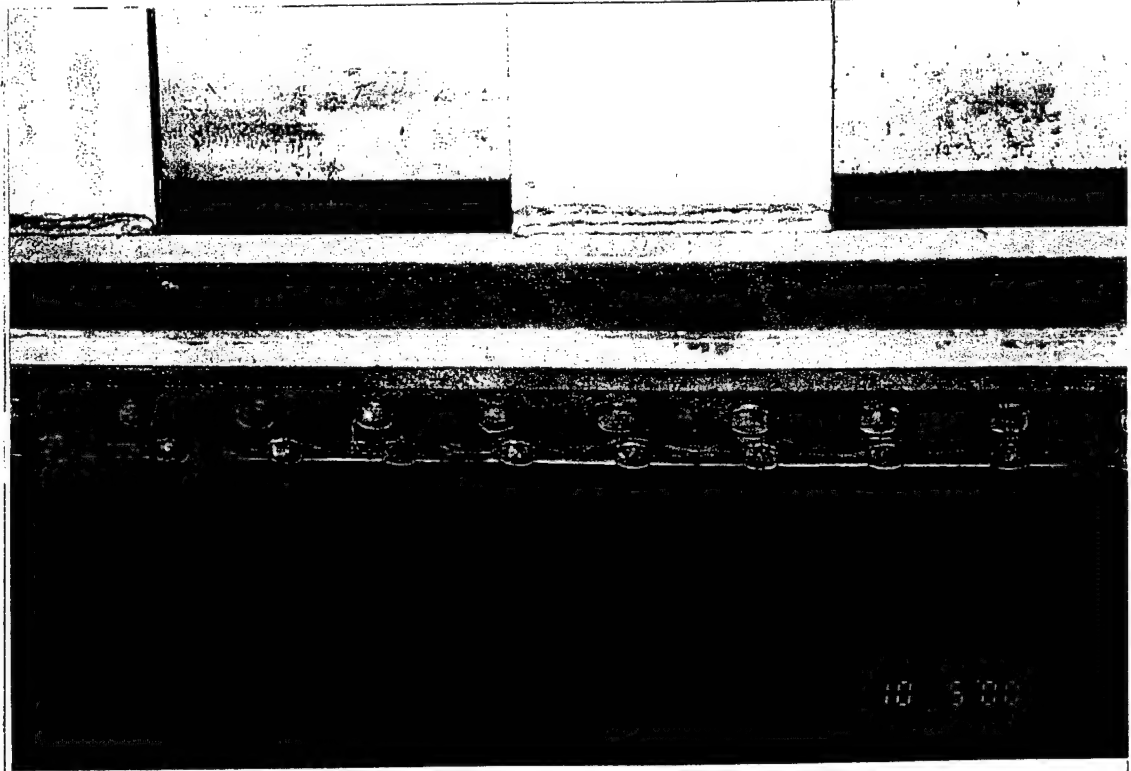
Lower  
Granite  
Dam

10/05/00

6-21

**Gate 6**

Bottom seal closure plate and skin plate looking upstream. Standing water between closure plate, purlin webs and skinplate, typical.



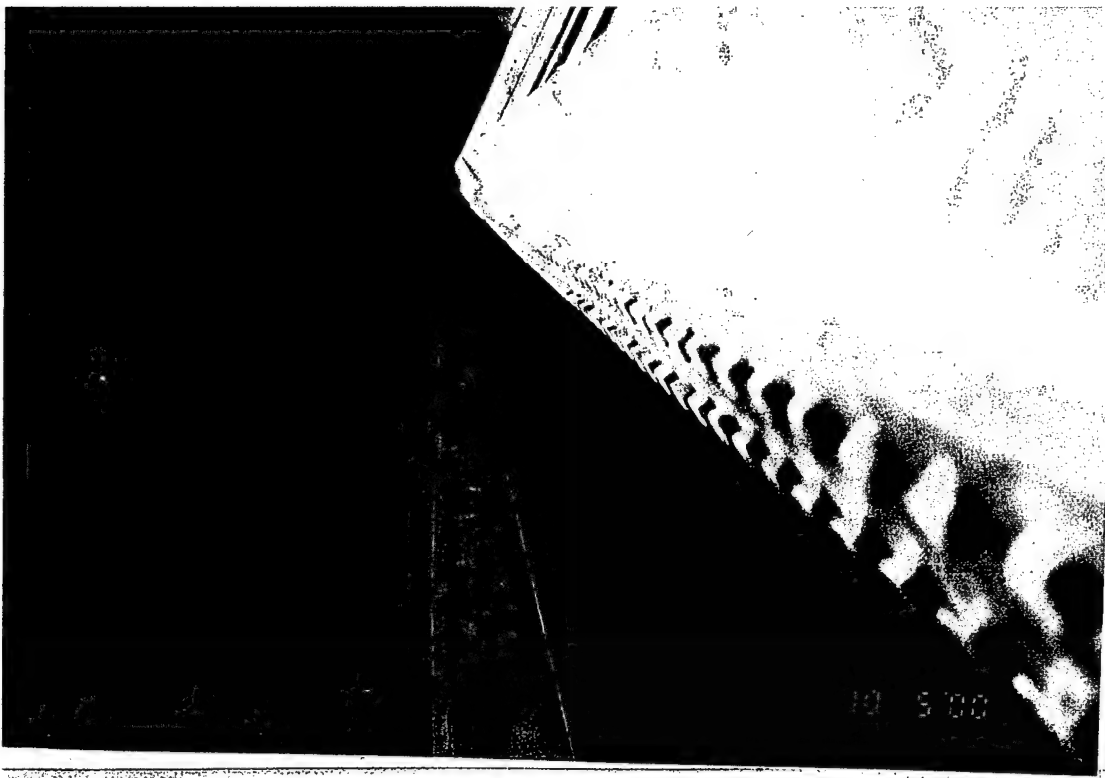
Lower  
Granite  
Dam

10/05/00

6-22

**Gate 6**

Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate, typical.



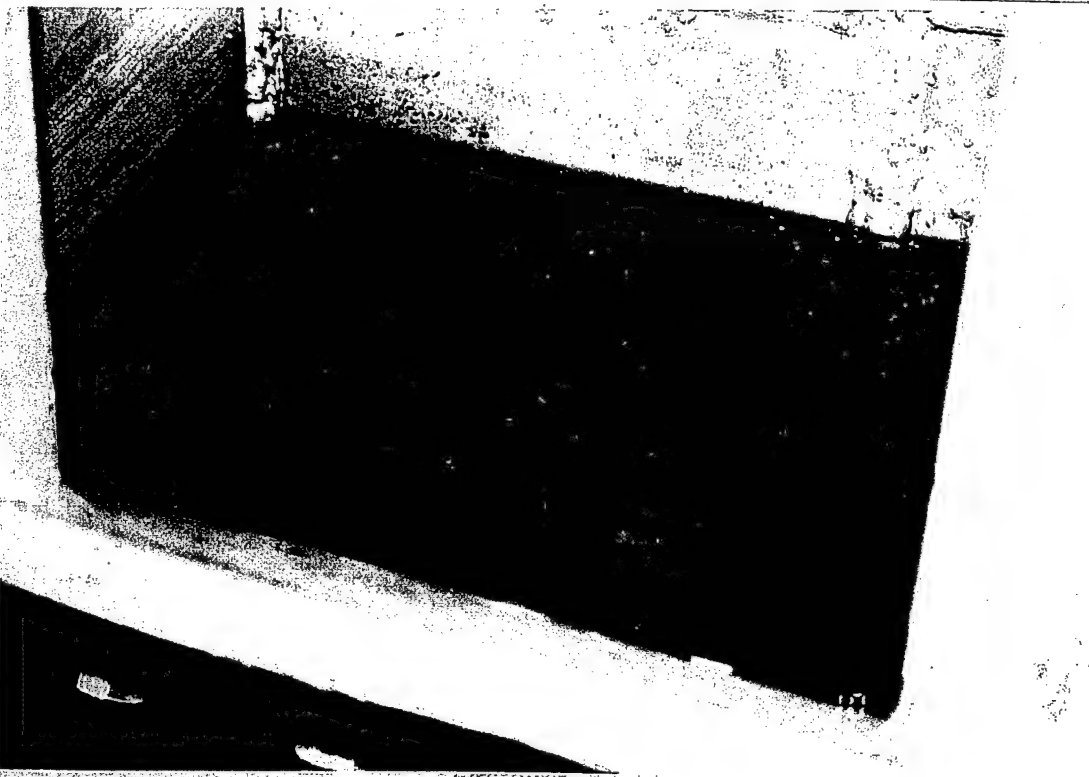
Lower  
Granite  
Dam

**Gate 6**

Embedded bottom seal plate, typical.

10/05/00

6-23



Lower  
Granite  
Dam

**Gate 6**

Bottom seal closure plate looking upstream. Standing water between closure plate, purlin webs and skinplate, Note: good condition of stainless steel bolts and nuts.

10/05/00

6-24

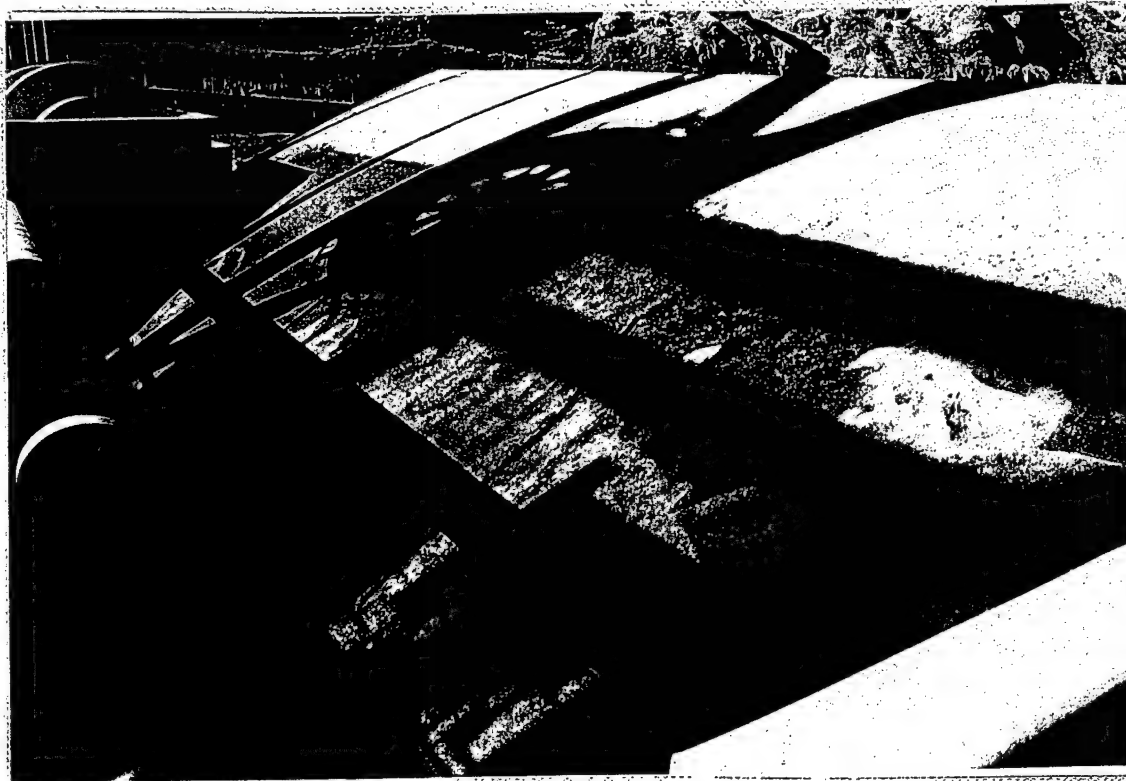


Lower  
Granite  
Dam

Gate 6  
Skin plate pitting, typical.

10/05/00

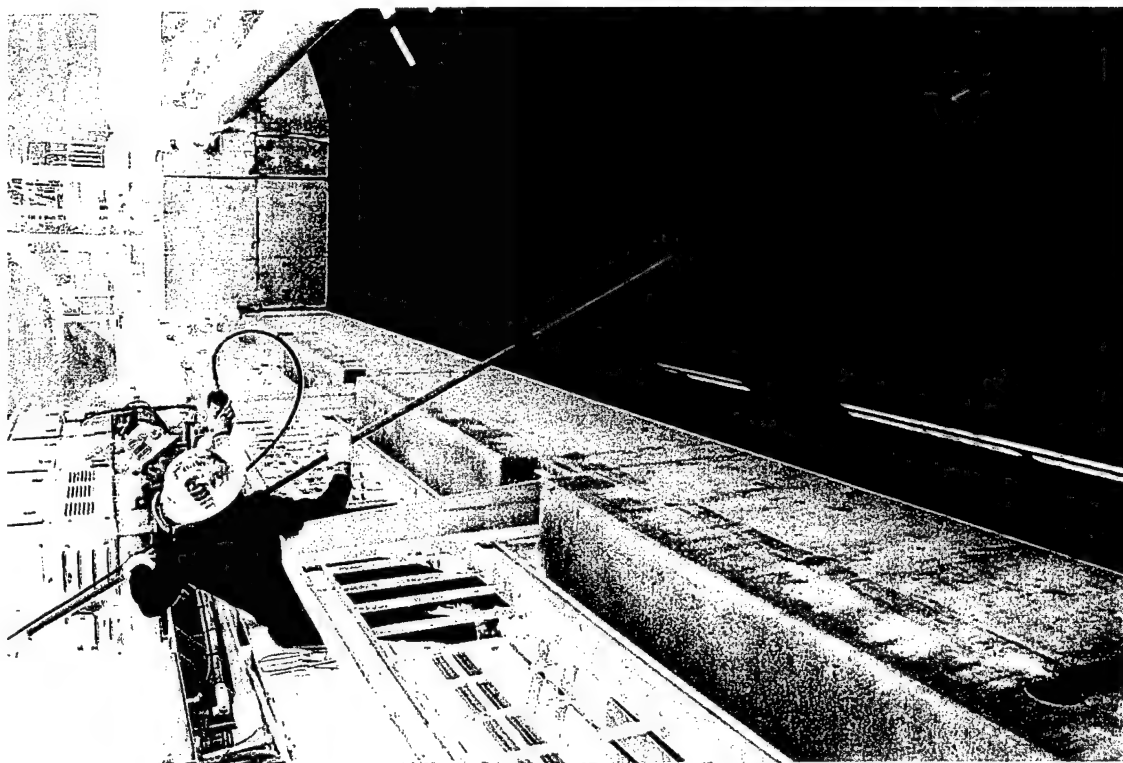
6-25



Lower  
Granite  
Dam

Gate 6  
Typical skin plate condition.

10/05/00



Lower Gate 6  
Granite Waterblasting of skin plate, typical.  
Dam

10/05/00

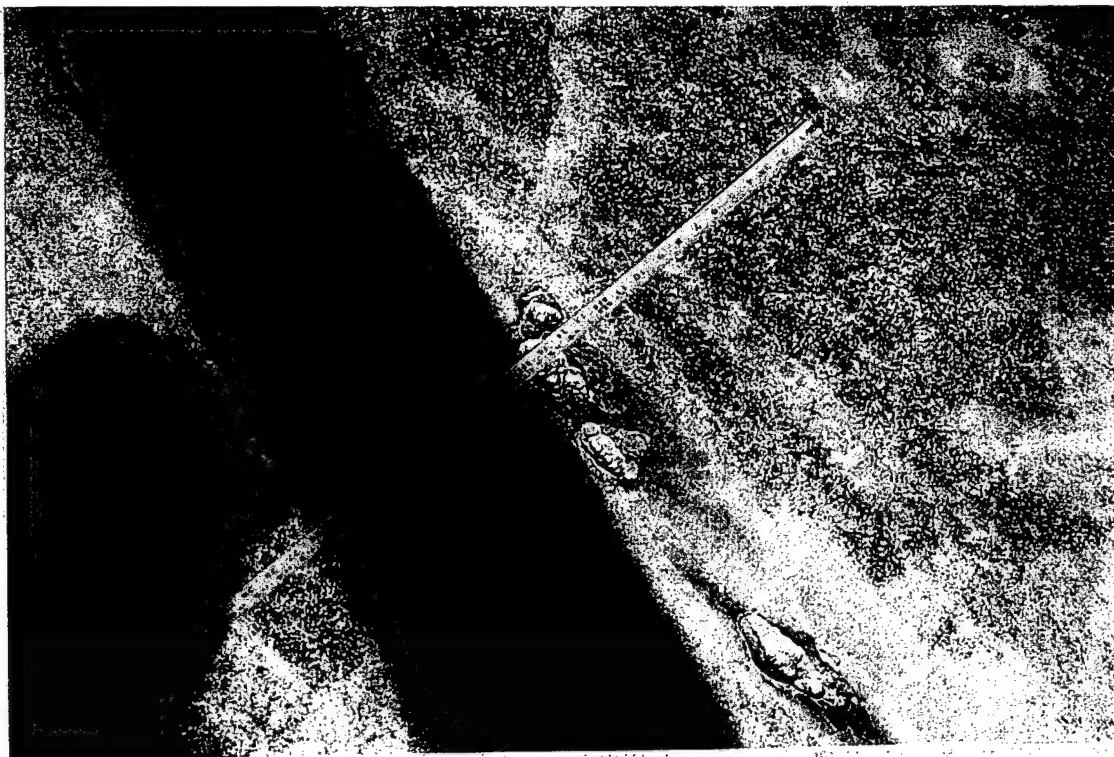
6-27



Lower Gate 6  
Granite Waterblasting of skin plate, typical.  
Dam

10/05/00

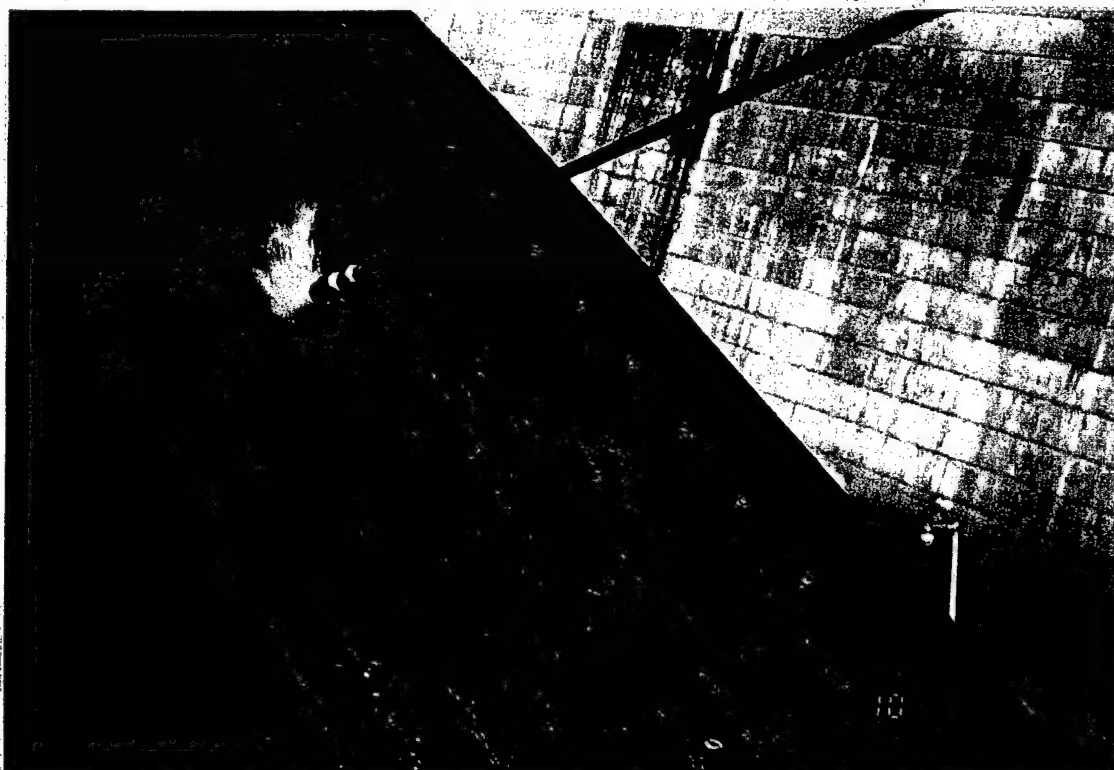
6-28



Lower Gate 6  
Granite Skin plate pitting, typical.  
Dam

10/05/00

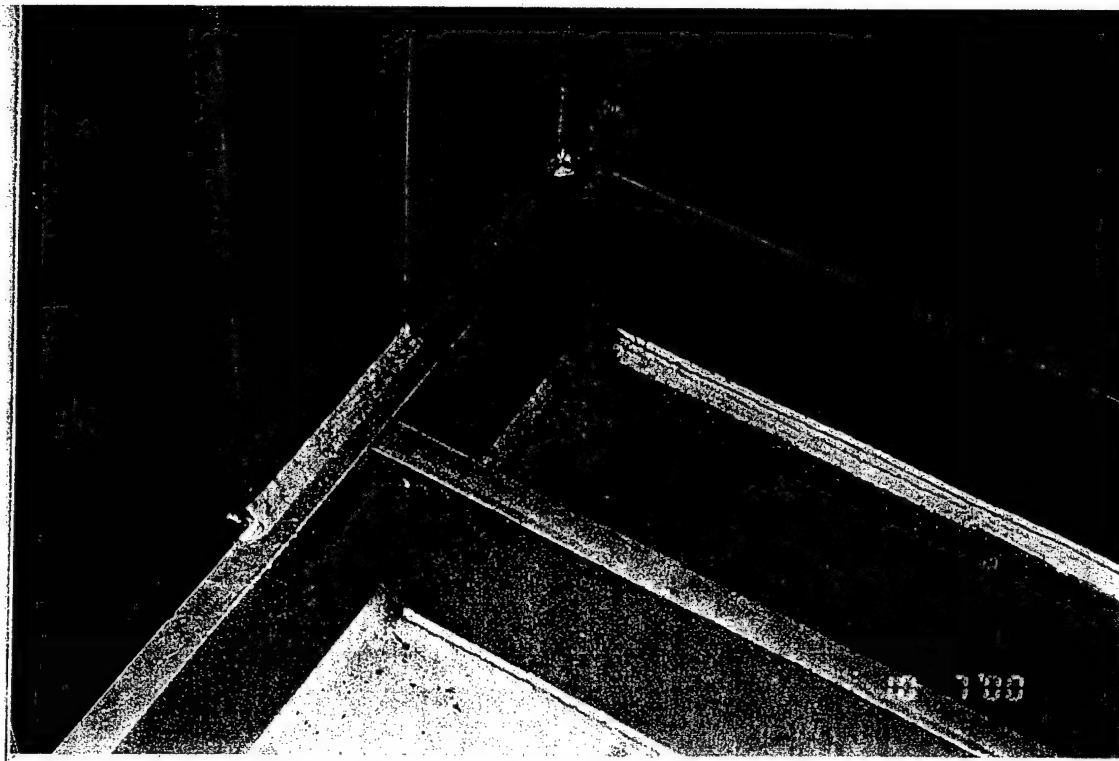
6-29



Lower Gate 6  
Granite Typical wear plate condition. Light  
Dam grooves due to cable wear, light to  
moderate corrosion.

10/05/00

6-30



Lower  
Granite  
Dam

10/07/00

7-1

#### Gate 7

Horizontal girder stiffeners at left  
frame middle radial strut. Note:  
upstream end of stiffeners not welded  
to girder flange. Correct per plans.



Lower  
Granite  
Dam

10/07/00

7-2

#### Gate 7

Left end of bottom horizontal girder.  
Standing water, no drainage between  
multiple stiffeners. Horizontal girder  
to skin plate stiffeners, standing  
water, debris and no drainage



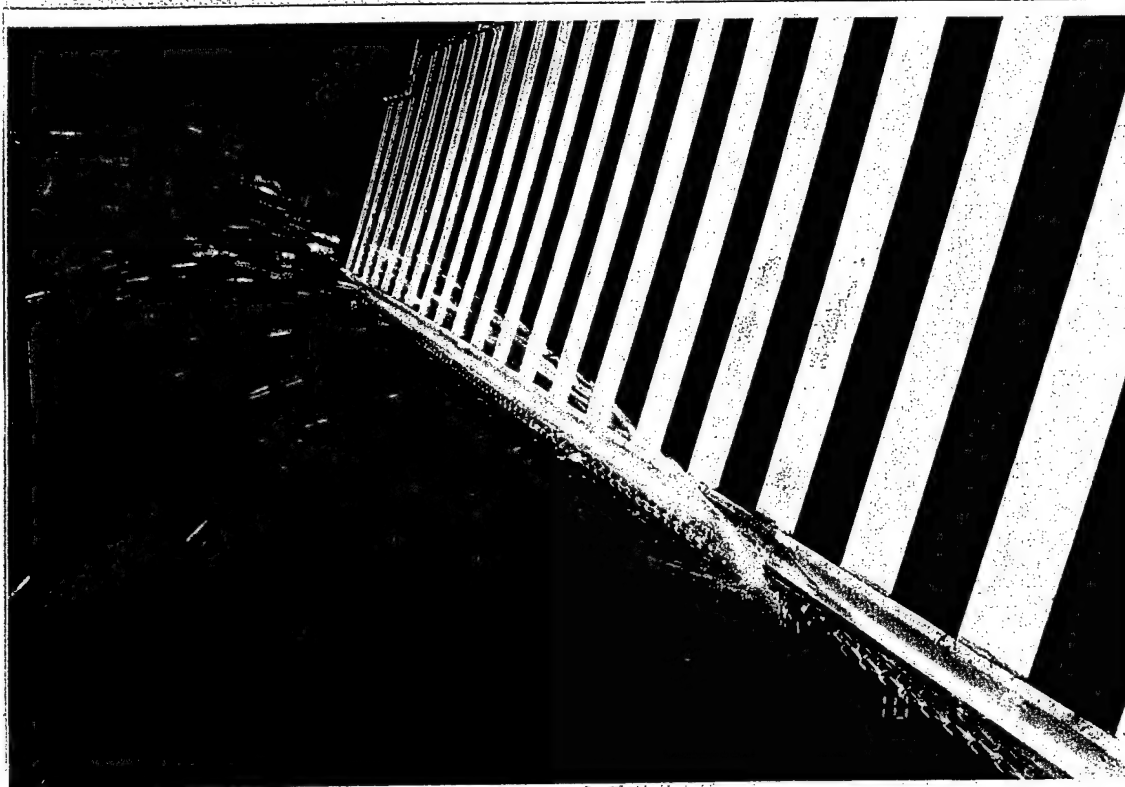


Lower  
Granite  
Dam

10/07/00

7-3

**Gate 7**  
Bottom seal closure plate looking  
upstream. Standing water between  
closure plate, purlin webs and  
skinplate. Typical.



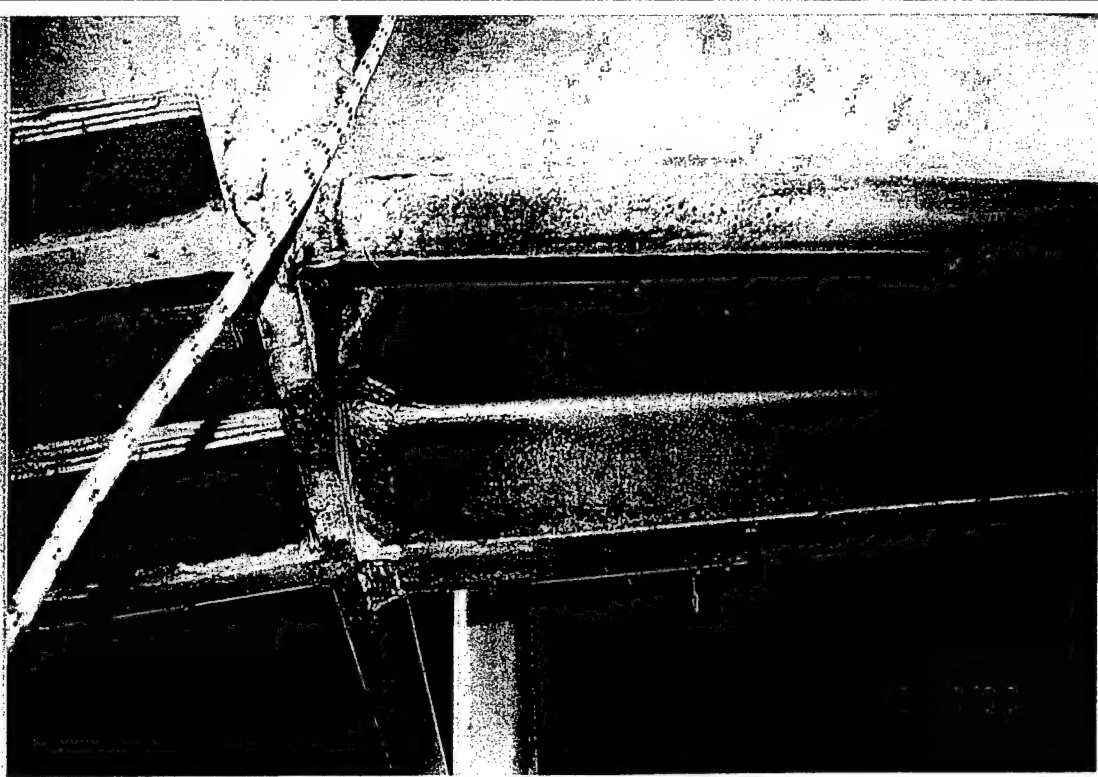
Lower  
Granite  
Dam

10/07/00

7-4

**Gate 7**  
Leak at center construction joint in  
spillway monolith.





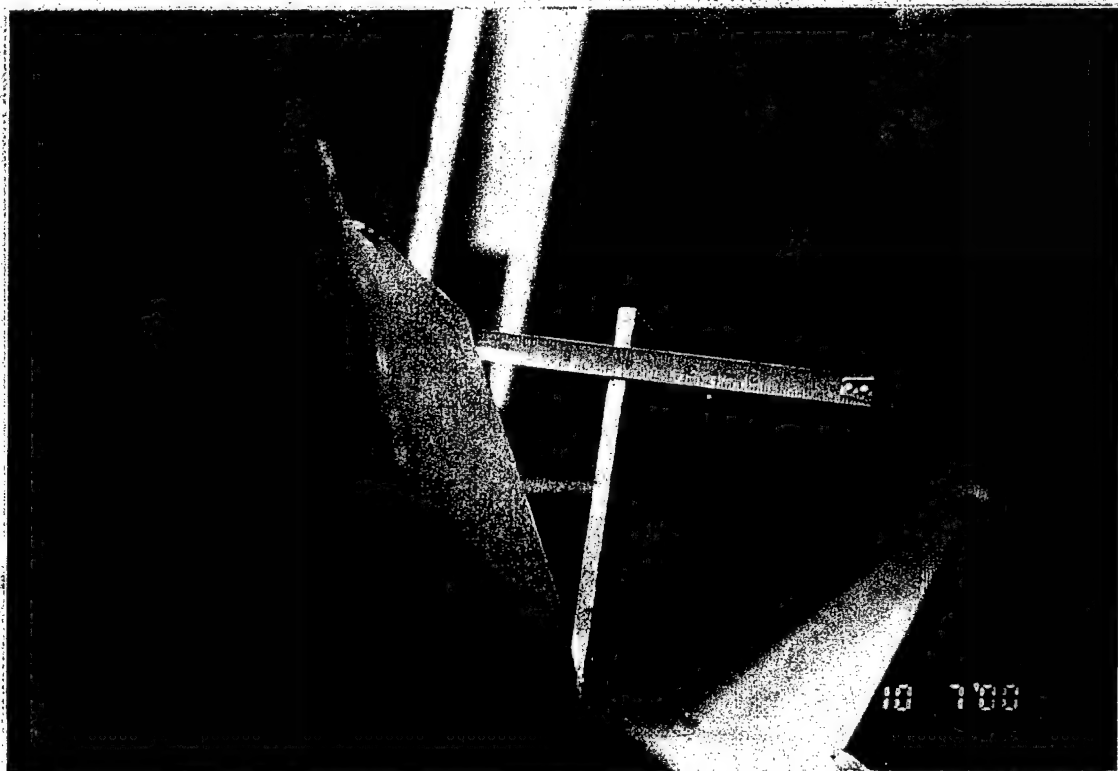
Lower  
Granite  
Dam

10/07/00

7-5

**Gate 7**

Bottom of bottom left radial strut.  
Light corrosion at connection to  
bottom girder. Note: Discolorization  
on strut flange due to ultrasonic  
testing gel.



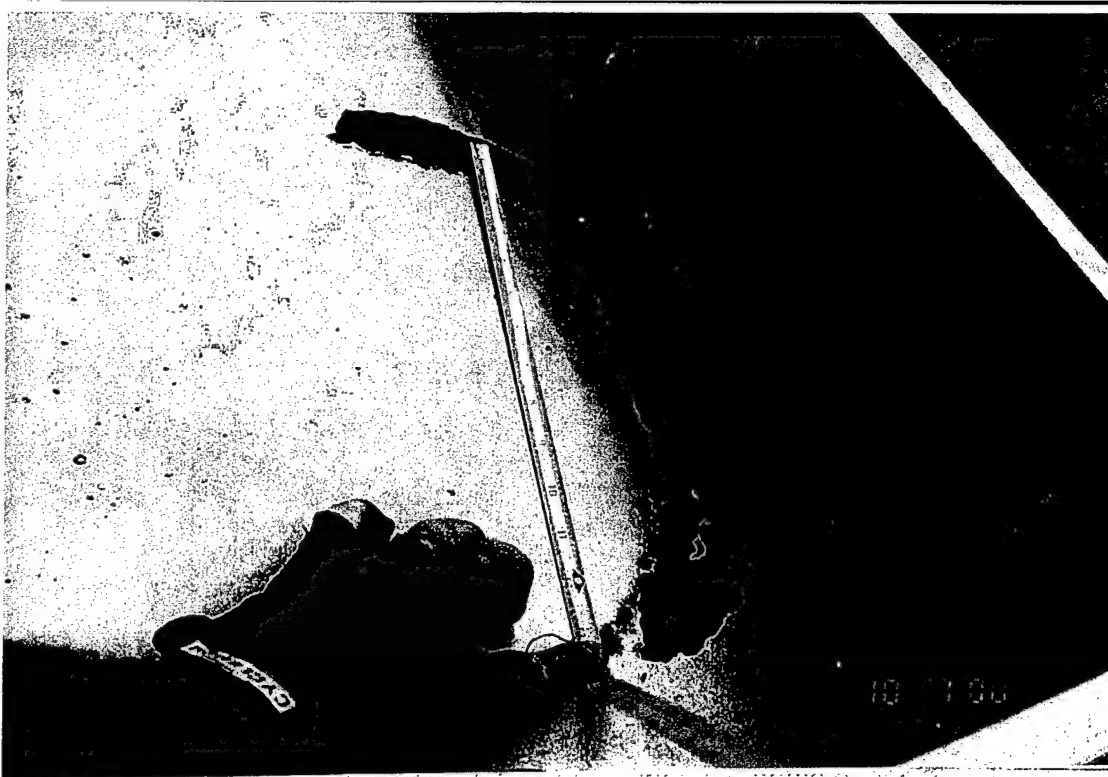
Lower  
Granite  
Dam

10/07/00

7-6

**Gate 7**

Right horizontal girder bracing A to  
K. Deformed web in brace K.



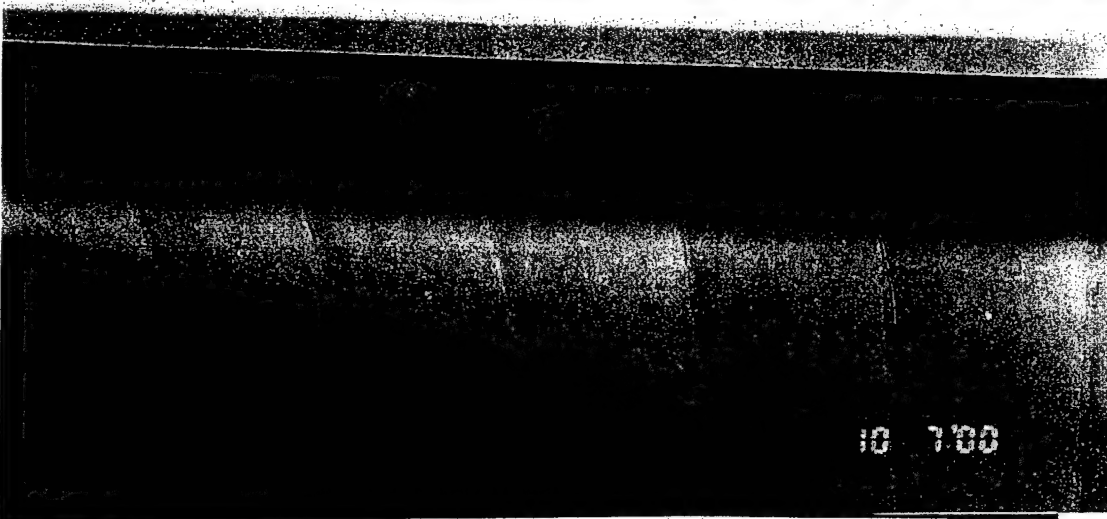
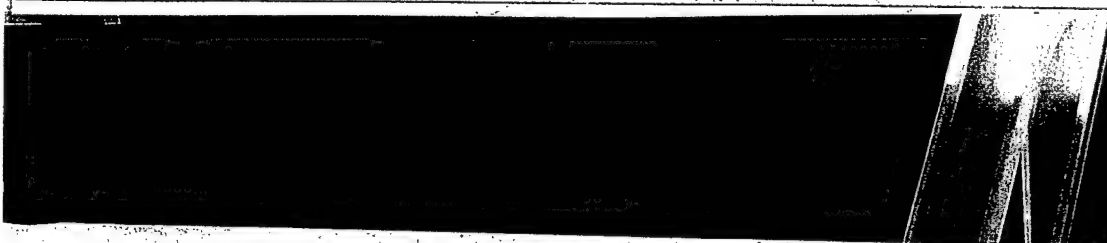
Lower  
Granite  
Dam

10/07/00

7-7

**Gate 7**

Top horizontal girder near right radial  
strut connection. Light corrosion



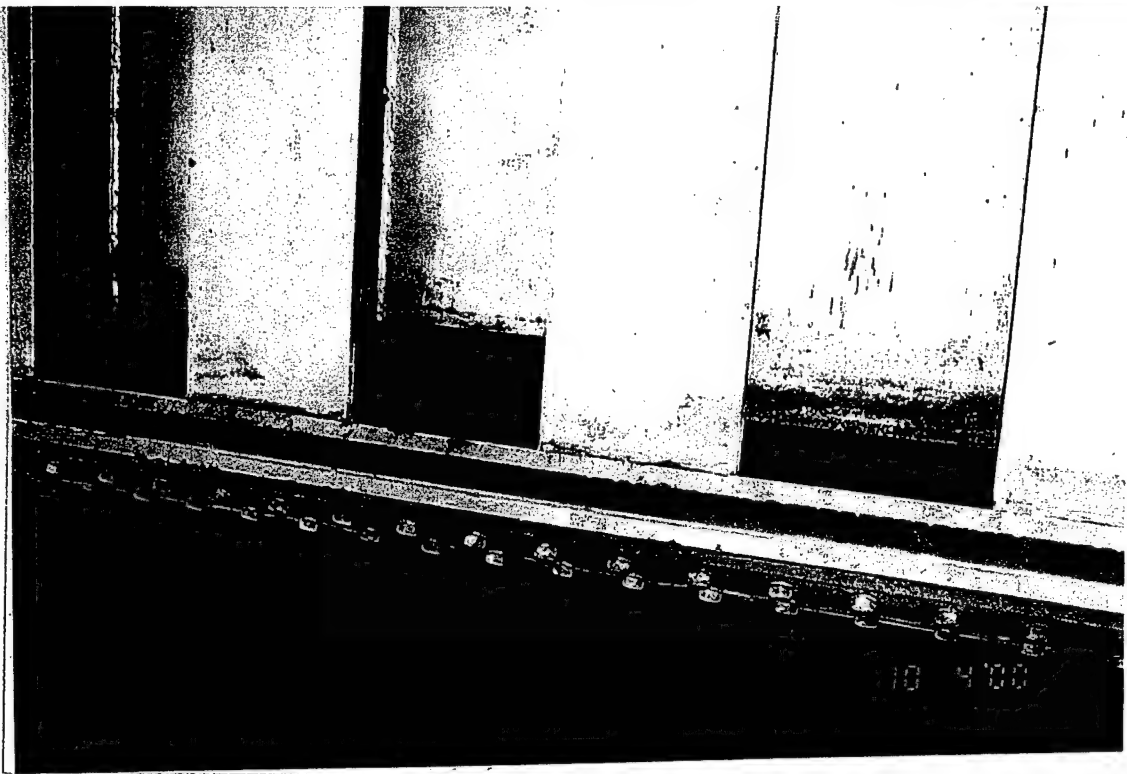
Lower  
Granite  
Dam

10/07/00

7-8

**Gate 7**

Upstream surface of skin plate,  
typical. Note: Weld lines for purlins  
visible through 3/8" skin plate.



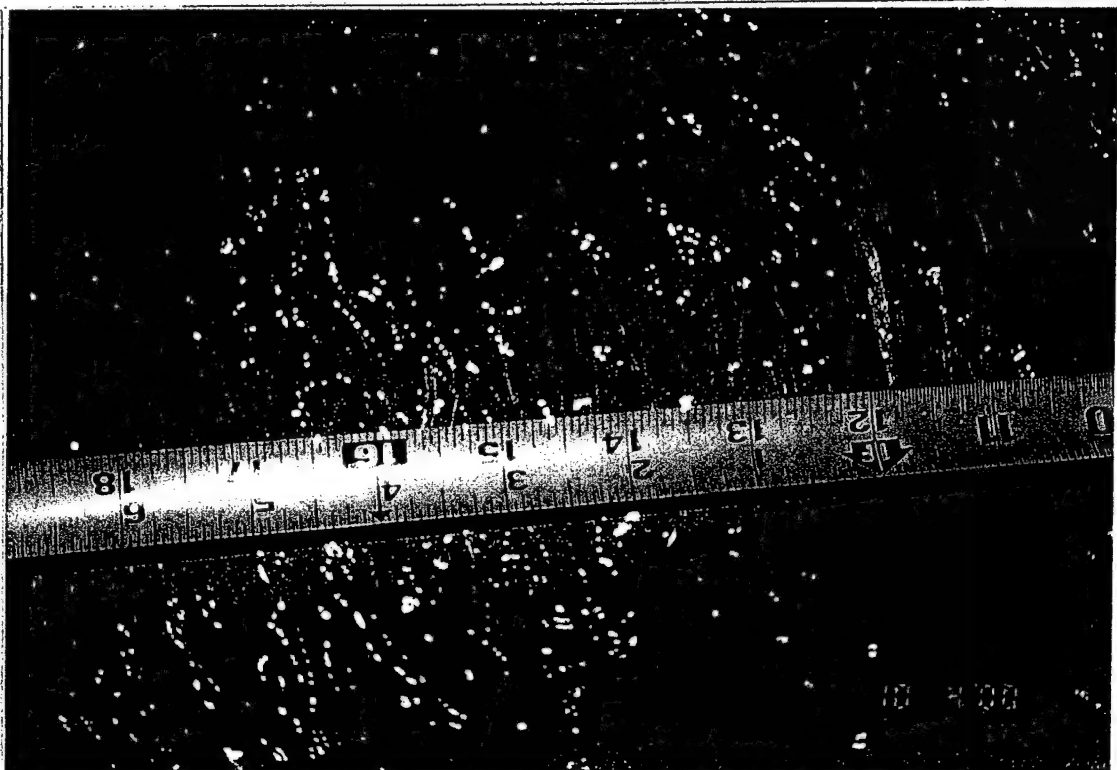
Lower  
Granite  
Dam

10/04/00

7-9

#### Gate 7

Bottom seal closure plate looking  
upstream. Standing water between  
closure plate, purlin webs and  
skinplate. Typical.



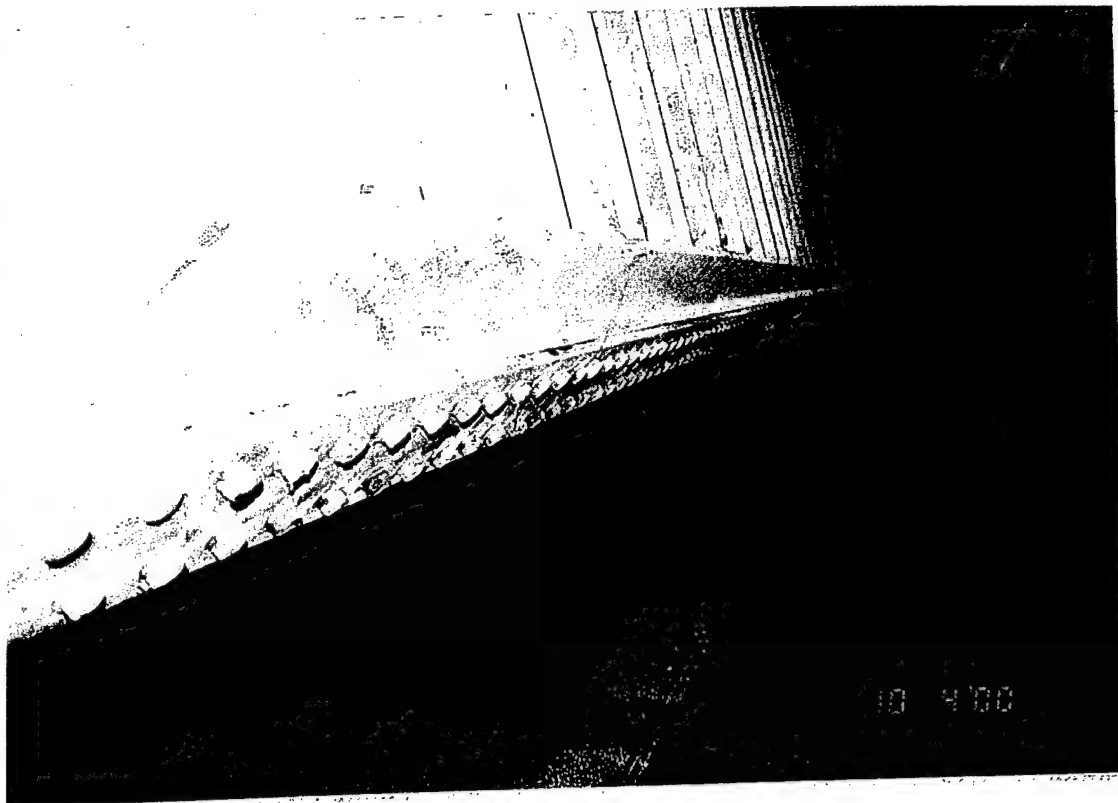
Lower  
Granite  
Dam

10/04/00

7-10

#### Gate 7

Close up embedded bottom seal plate,  
typical.



Lower  
Granite  
Dam

10/04/00

7-11

Gate 7  
Bottom seal keeper plate and  
embedded bottom seal plate, typical.

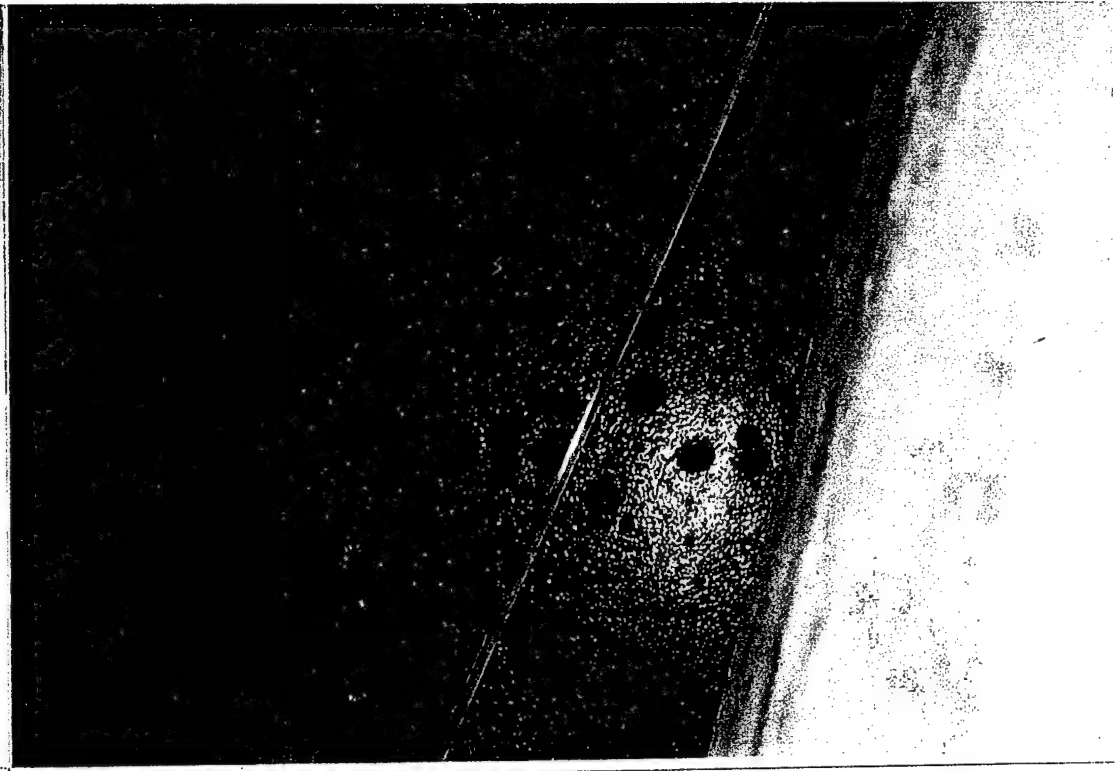


Lower  
Granite  
Dam

10/04/00

7-12

Gate 7  
Skin plate pitting, typical.



Lower  
Granite  
Dam

10/04/00

7-13

Gate 7  
Skin plate pitting, typical.



Lower  
Granite  
Dam

10/04/00

7-14

Gate 7  
Typical skin plate condition. Heavy  
pitting. Note: Pitting often appears  
to be oriented in lines associated  
with scratches.

00.4 01

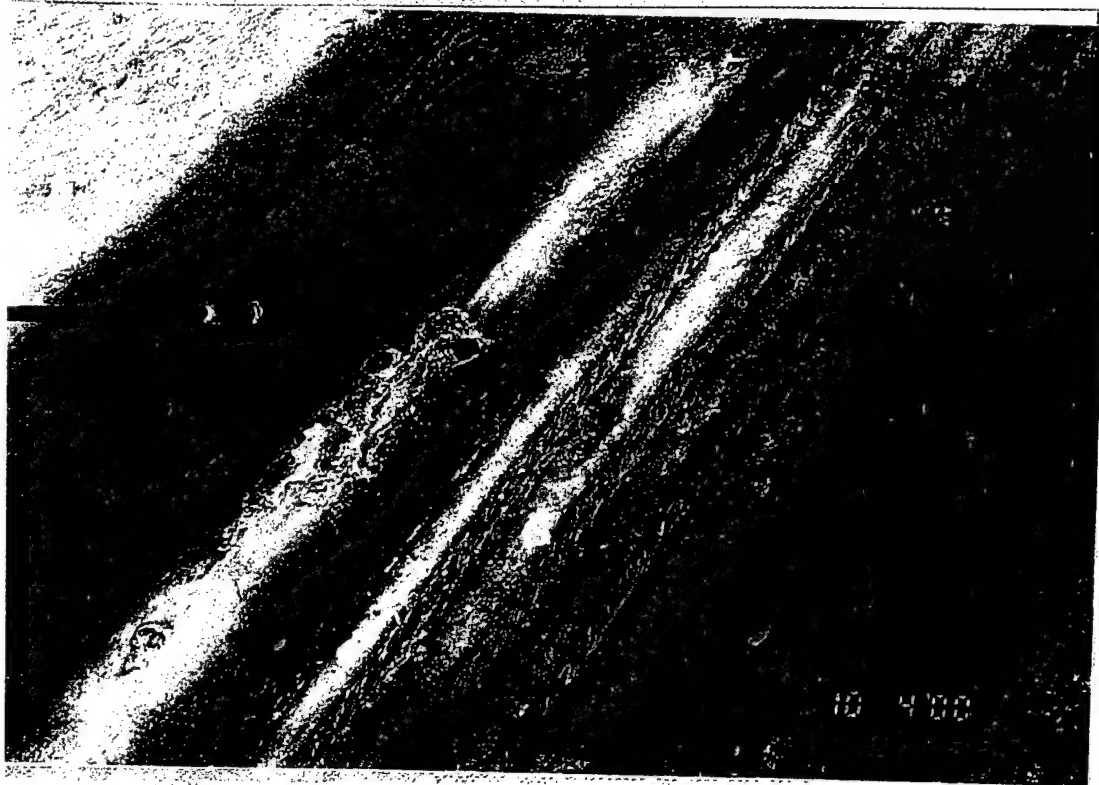
Lower  
Granite  
Dam

10/04/00

7-15

**Gate 7**

Skin plate pitting, typical. Note:  
Pitting appears to be oriented in line  
associated with scratch.



10 4'00

Lower  
Granite  
Dam

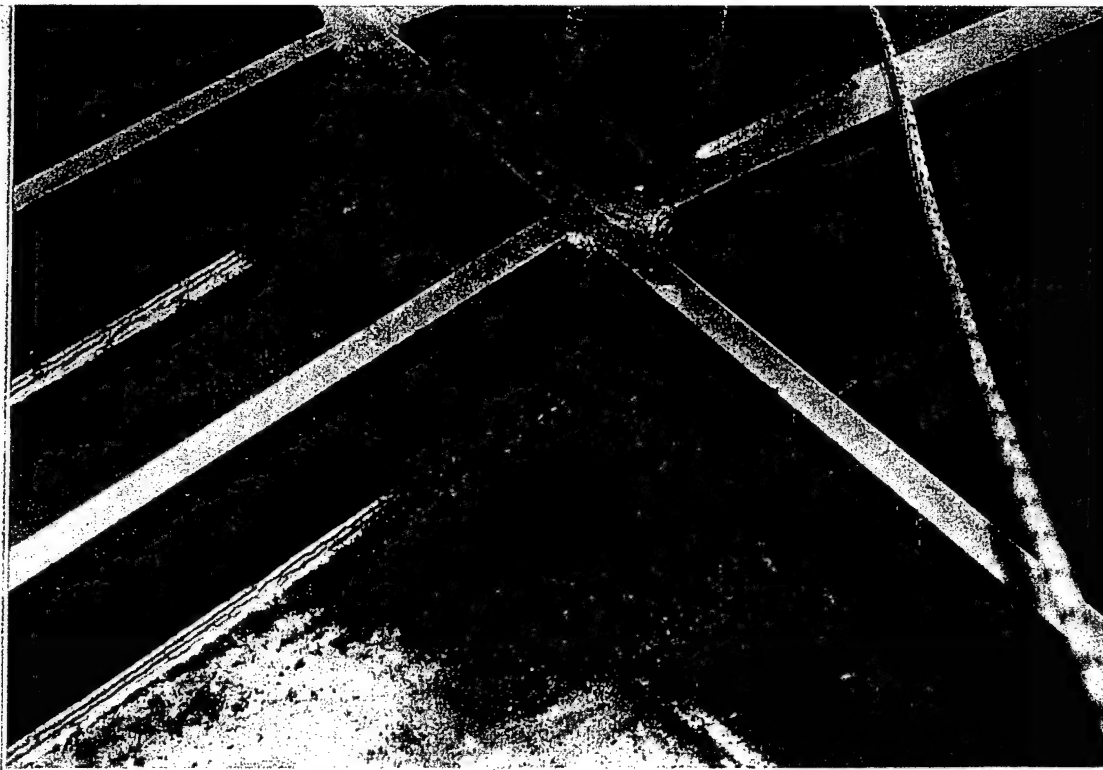
10/04/00

7-16

**Gate 7**

Typical wear plate condition. Light  
grooves due to cable wear, light to  
moderate corrosion.





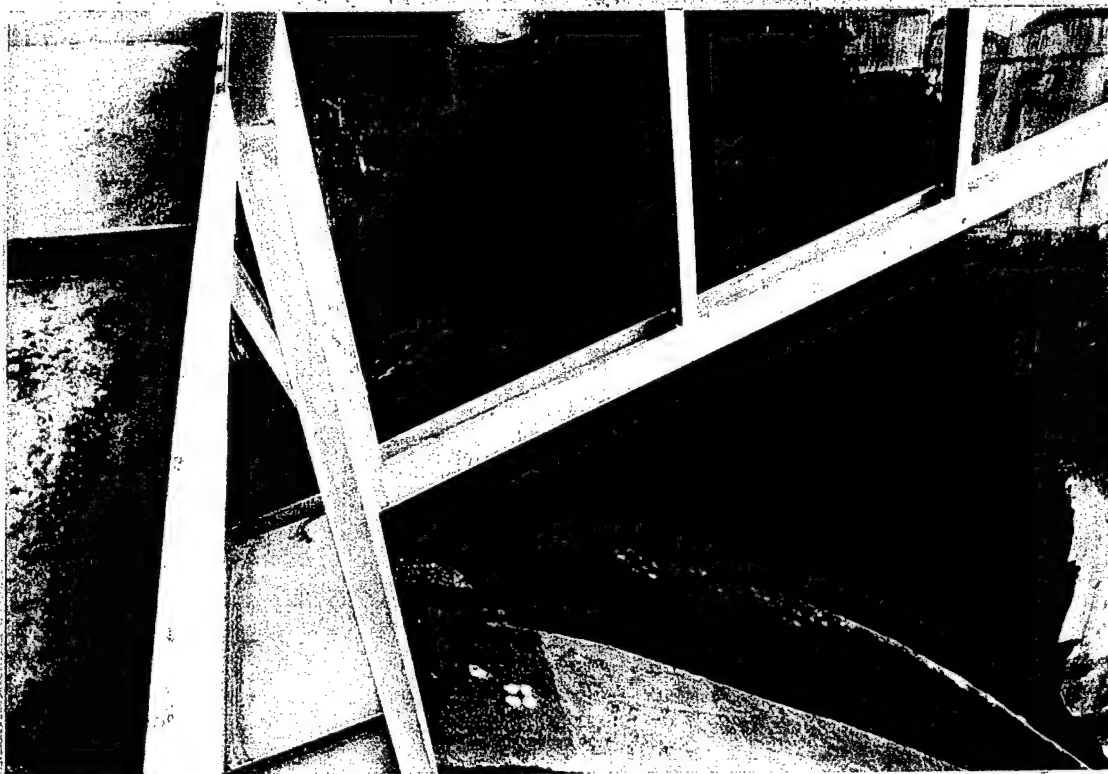
Lower  
Granite  
Dam

10/07/00

8-1

**Gate 8**

Middle horizontal girder at  
connection to middle right strut.  
Debris and evidence of standing  
water, light corrosion.



Lower  
Granite  
Dam

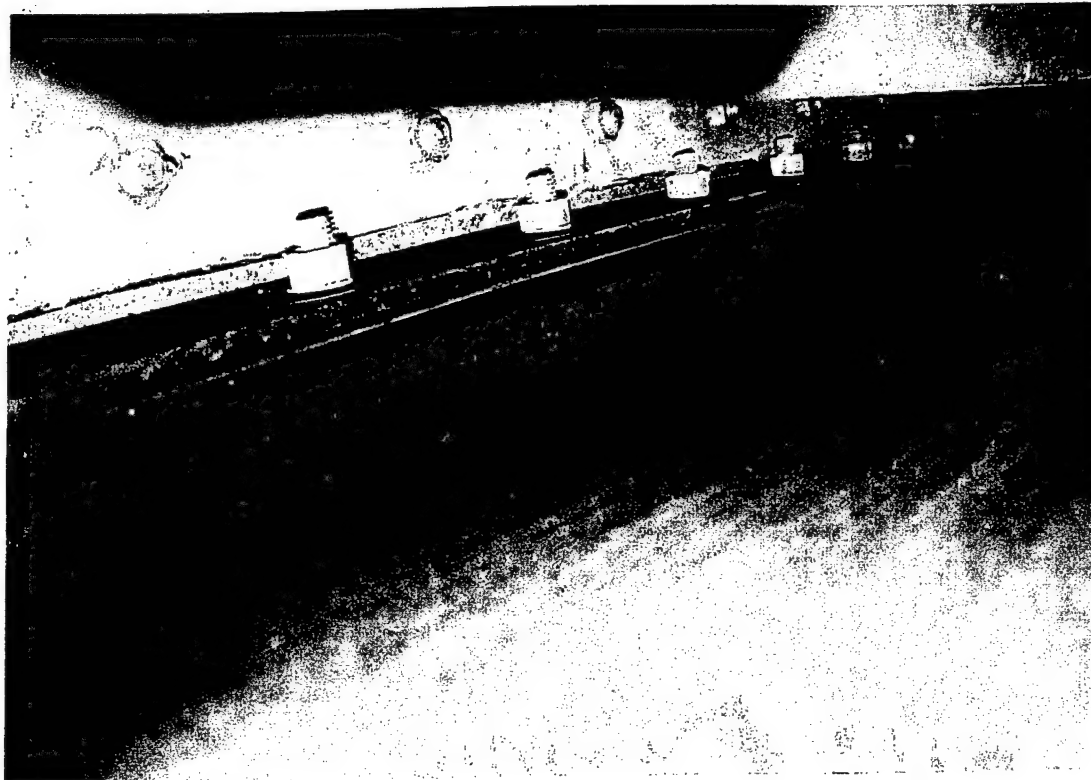
10/07/00

8-2

**Gate 8**

Bottom corner leak at left frame.





Lower  
Granite  
Dam

Gate 8  
Side seal, typical.

10/07/00

8-3



Lower  
Granite  
Dam

Gate 8  
Bottom right corner seal leak.

10/07/00

8-4

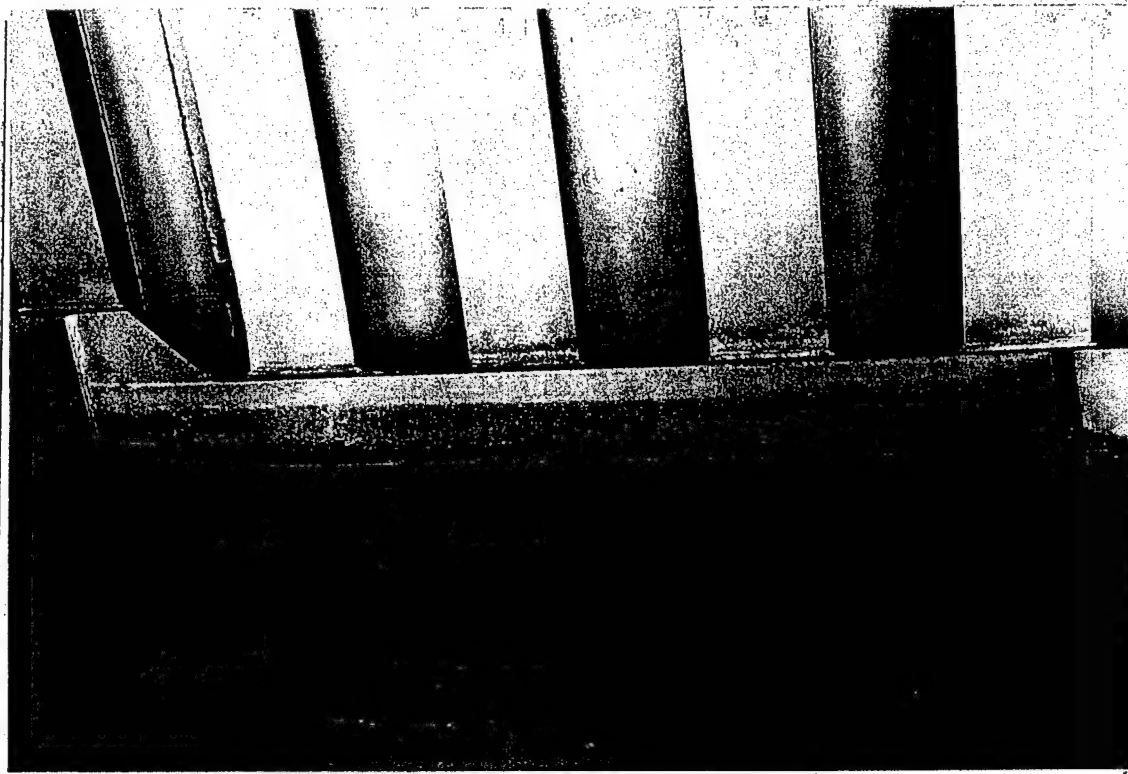


Lower  
Granite  
Dam

10/07/00

8-5

Gate 8  
Upstream end of bottom right strut.  
Standing water due to inadequate  
drainage.

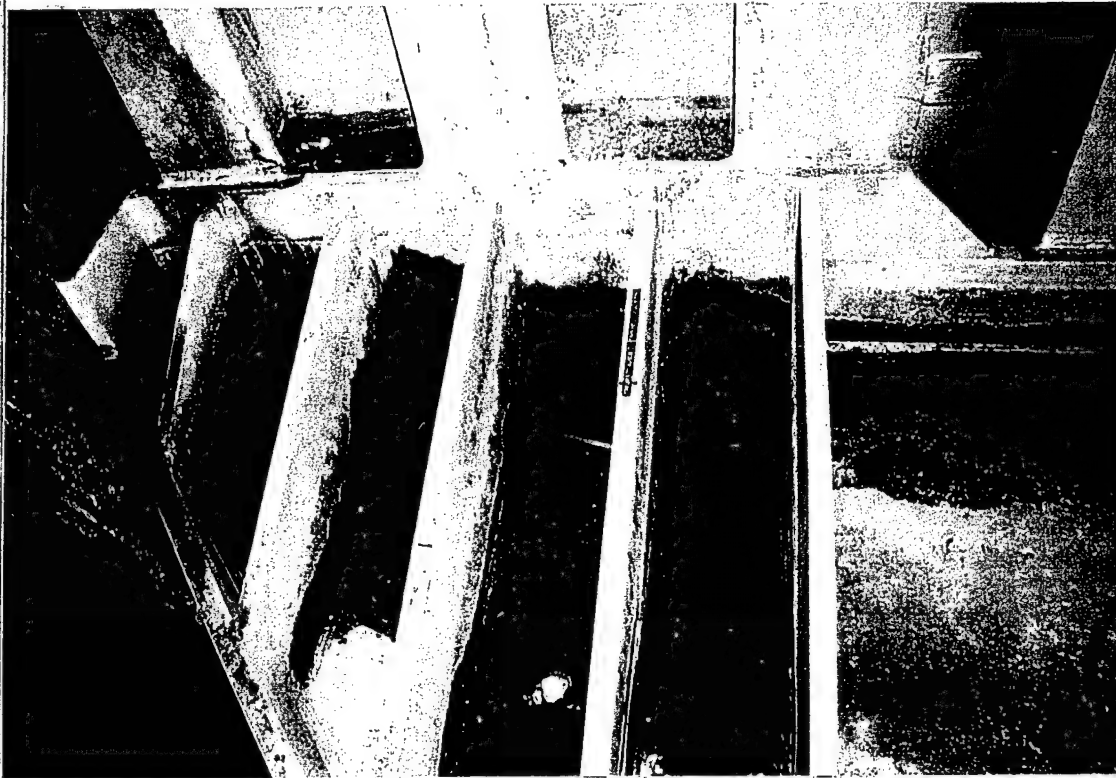


Lower  
Granite  
Dam

10/07/00

8-6

Gate 8  
Right upstream end of bottom  
horizontal girder. Standing water at  
upstream flange and web.



Lower  
Granite  
Dam

10/07/00

8-7

#### Gate 8

Right end of bottom horiz. girder.  
Standing water, no drainage between  
multiple stiffeners. Horizontal girder  
to skin plate stiffeners, standing  
water, debris and no drainage



Lower  
Granite  
Dam

10/07/00

8-8

#### Gate 8

Bottom seal keeper plate and leak at  
center construction joint in spillway  
monolith.



Lower  
Granite  
Dam

10/07/00

8-9

#### Gate 8

Bottom seal closure plate looking  
upstream. Standing water between  
closure plate, purlin webs and  
skinplate. Typical.



Lower  
Granite  
Dam

10/07/00

8-10

#### Gate 8

Downstream side of embedded  
bottom seal plate and small bottom  
left corner leak.



Lower  
Granite  
Dam

10/07/00

8-11

#### Gate 8

Spillway looking toward left side of gate. Bottom corner leak.



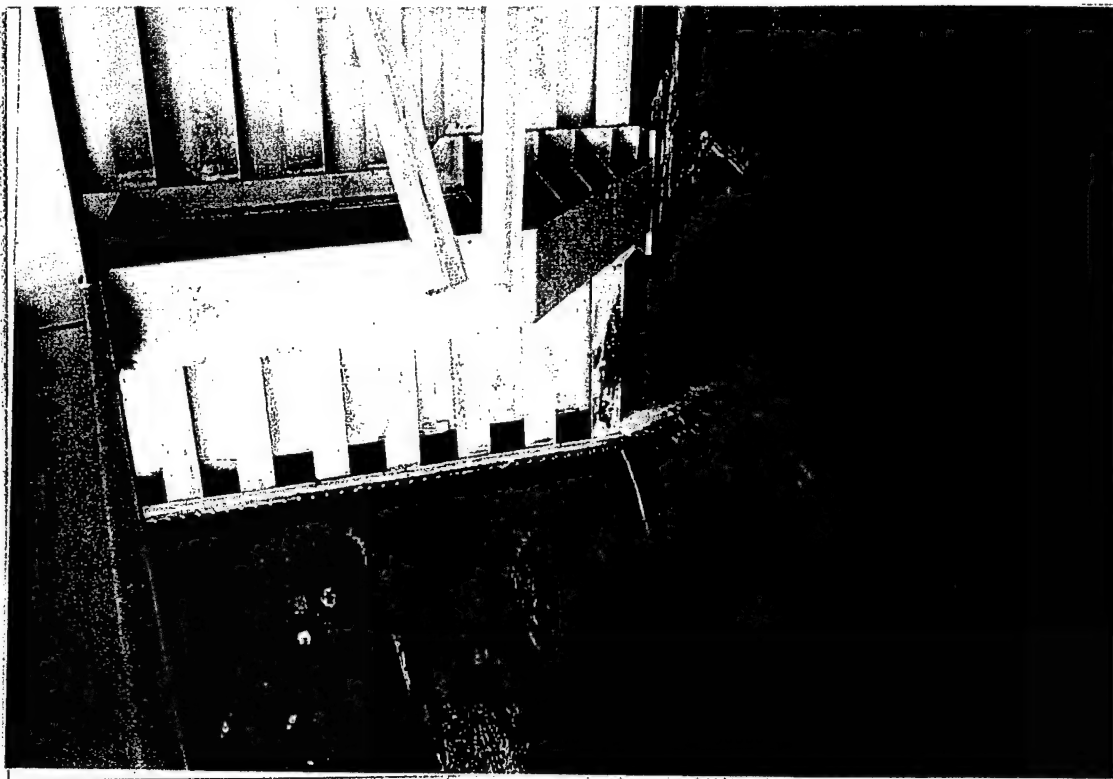
Lower  
Granite  
Dam

10/07/00

8-12

#### Gate 8

Left end of bottom horiz. girder. Standing water, no drainage between multiple stiffeners. Horizontal girder to skin plate stiffeners, debris and no drainage.



Lower  
Granite  
Dam

Gate 8  
Bottom left corner leak.

10/07/00

8-13



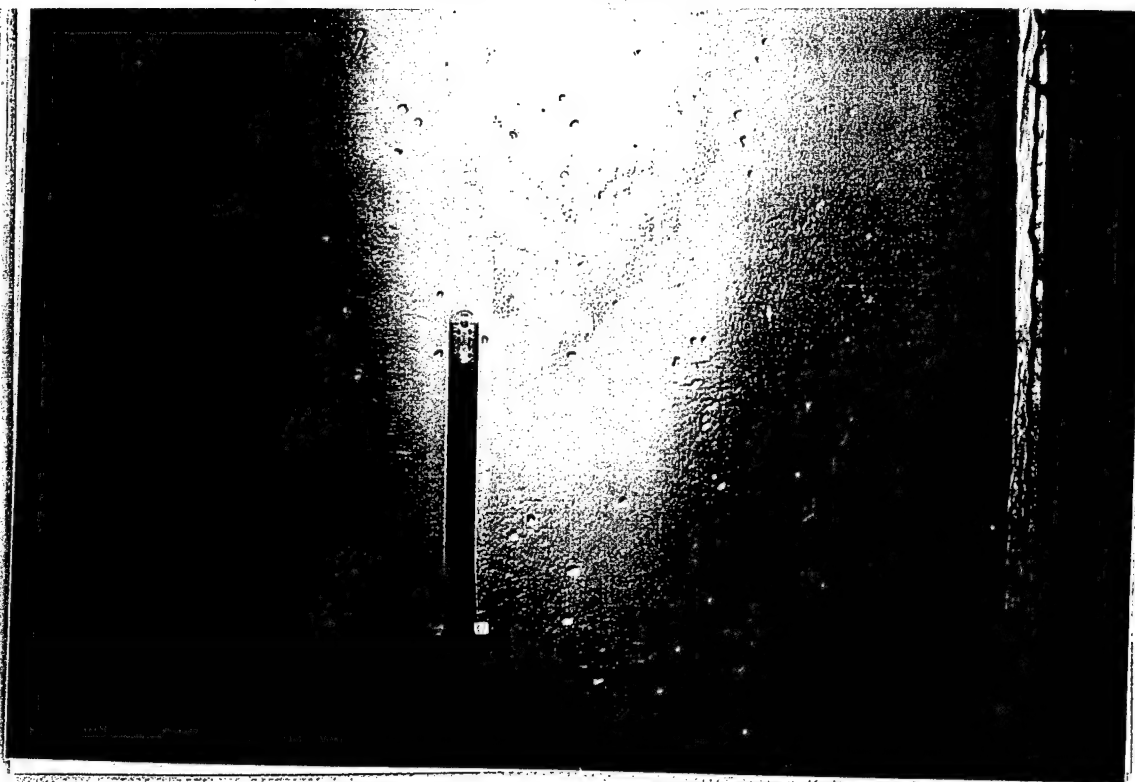
Lower  
Granite  
Dam

Gate 8  
Purlin flange small pitting, typical.

10/07/00

8-14



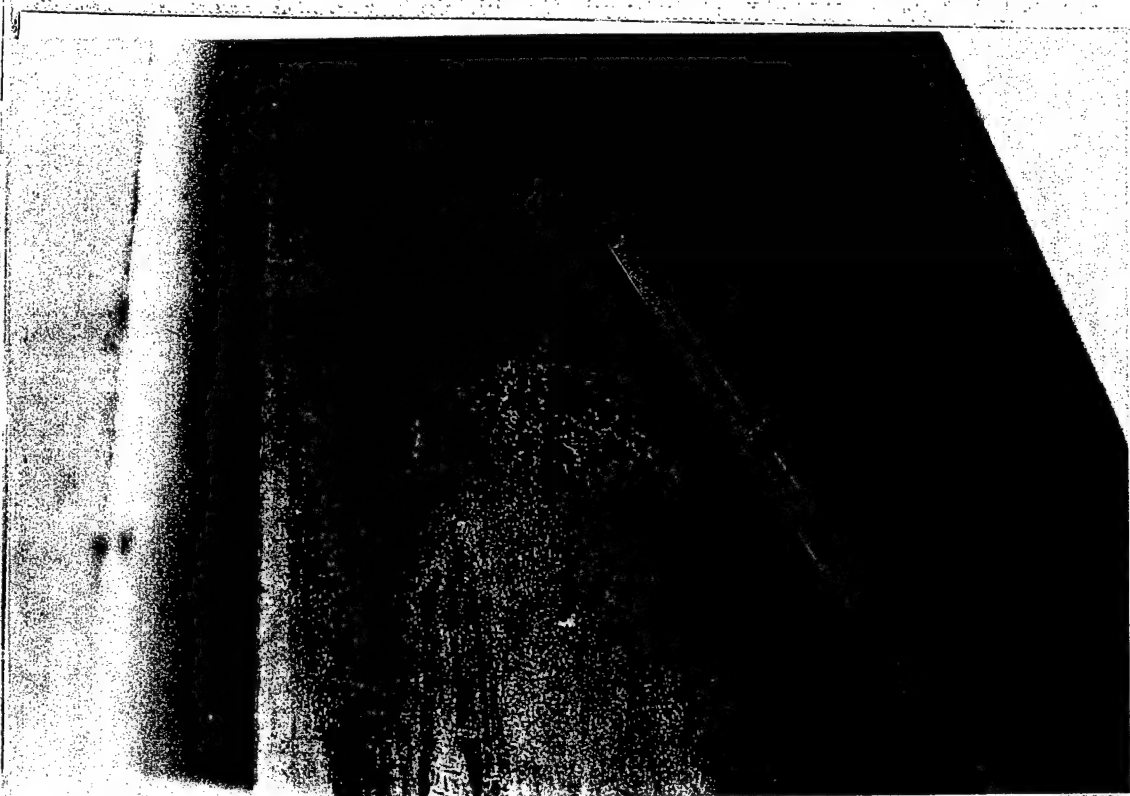


Lower  
Granite  
Dam

Gate 8  
Downstream surface of skin plate  
pitting, typical.

10/07/00

8-15



Lower  
Granite  
Dam

Gate 8  
Top left radial strut near trunnion.  
Light corrosion on top of web  
(before scraping).

10/07/00

8-16

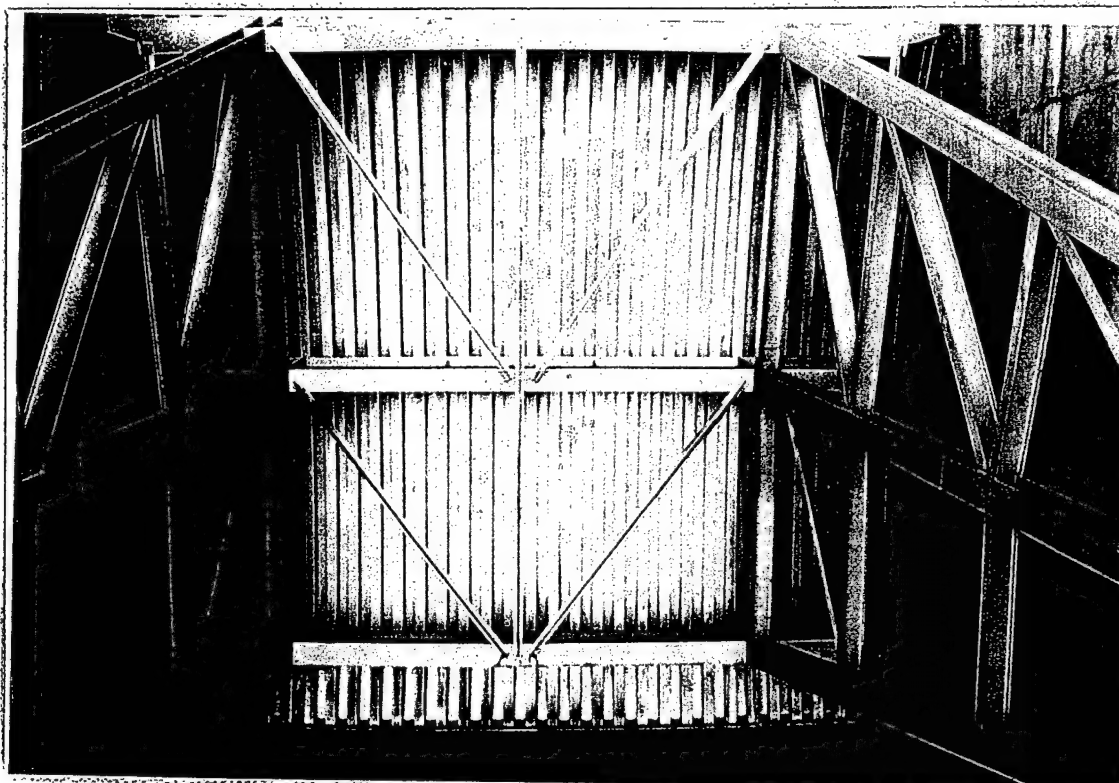


Lower  
Granite  
Dam

10/07/00

8-17

**Gate 8**  
Top left radial strut near trunnion.  
Light corrosion on top of web (after  
scraping).



Lower  
Granite  
Dam

10/07/00

8-18

**Gate 8**  
Gate looking upstream, typical.



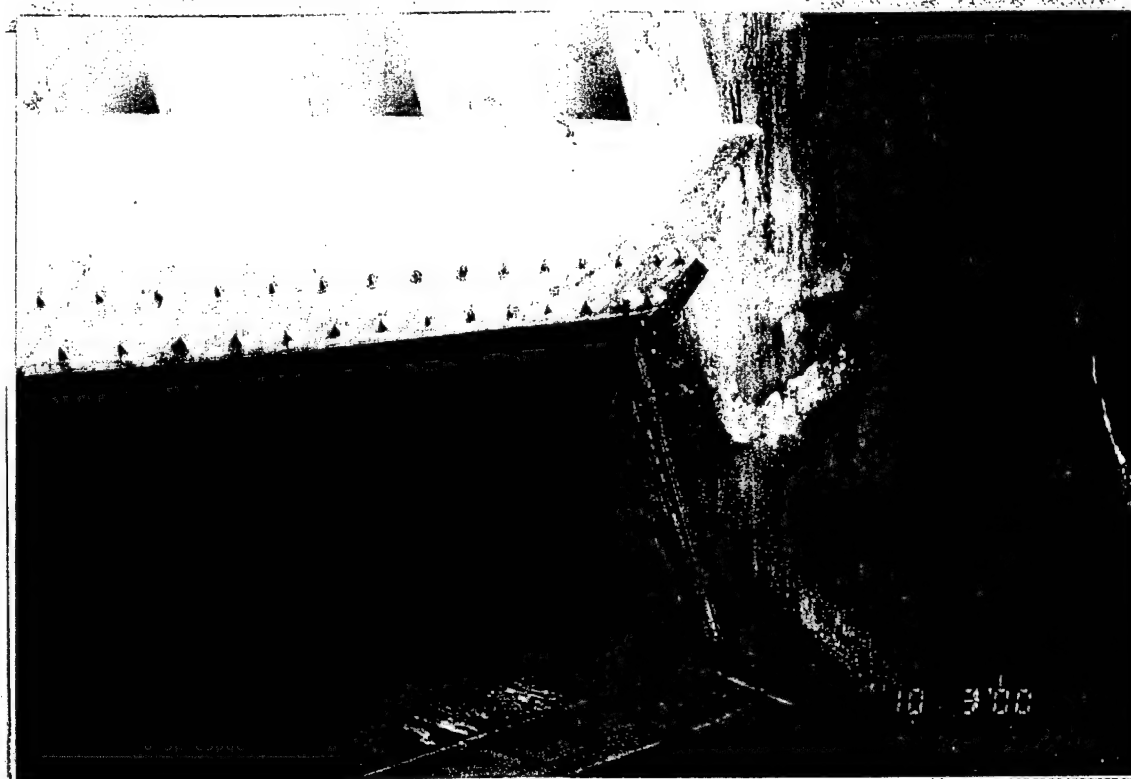
Lower  
Granite  
Dam

10/03/00

8-19

Gate 8

Embedded bottom seal plate, typical.



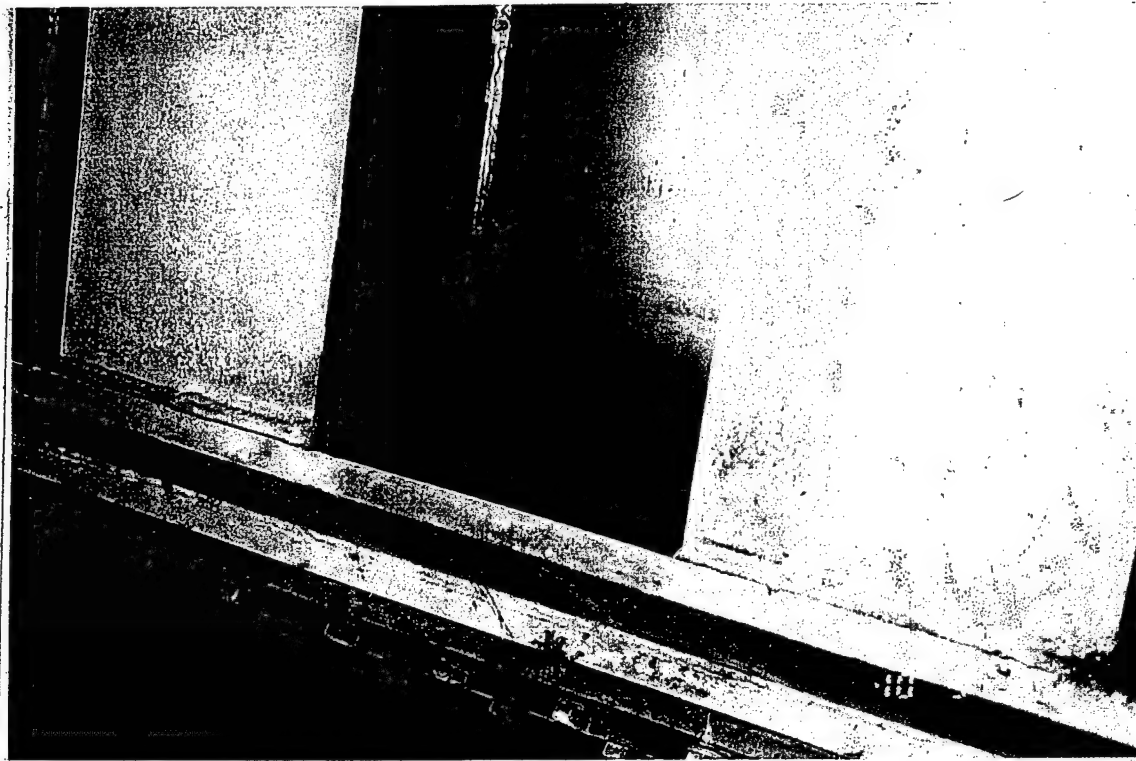
Lower  
Granite  
Dam

10/03/00

8-20

Gate 8

Bottom left corner of gate.



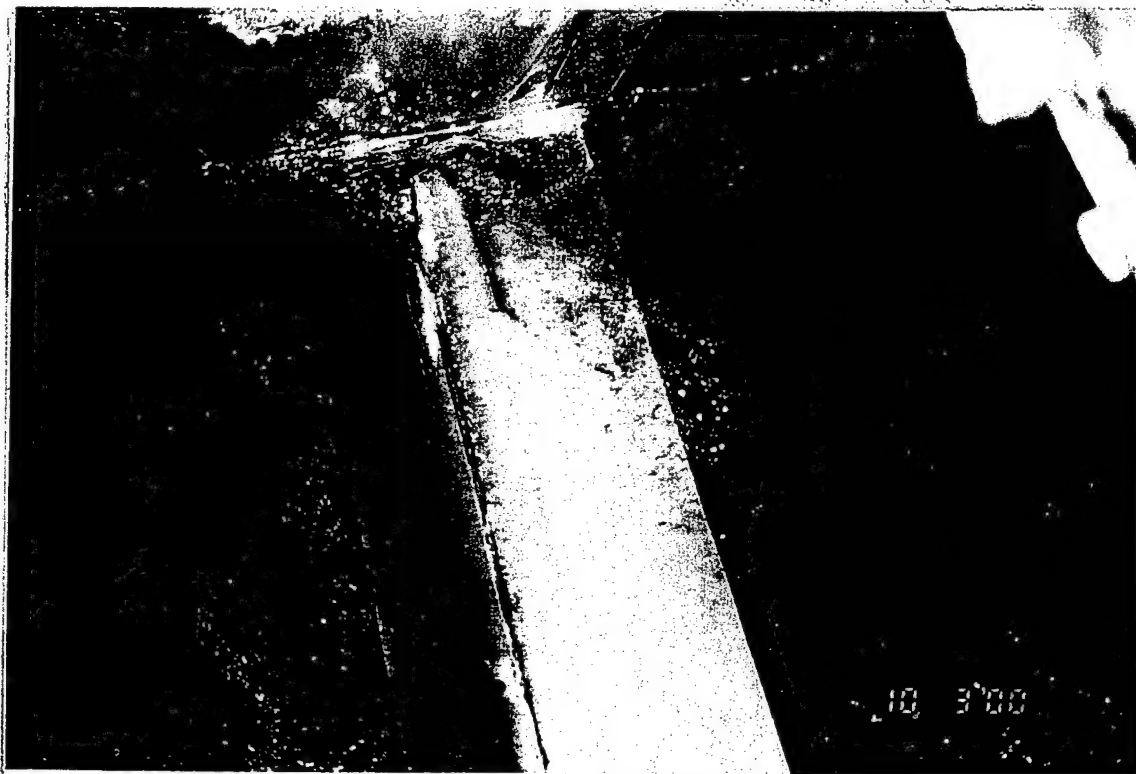
Lower  
Granite  
Dam

10/03/00

8-21

#### Gate 8

Bottom seal closure plate looking  
upstream. Standing water between  
closure plate, purlin webs and  
skinplate. Typical.



Lower  
Granite  
Dam

10/03/00

8-22

#### Gate 8

Embedded bottom seal plate, typical.



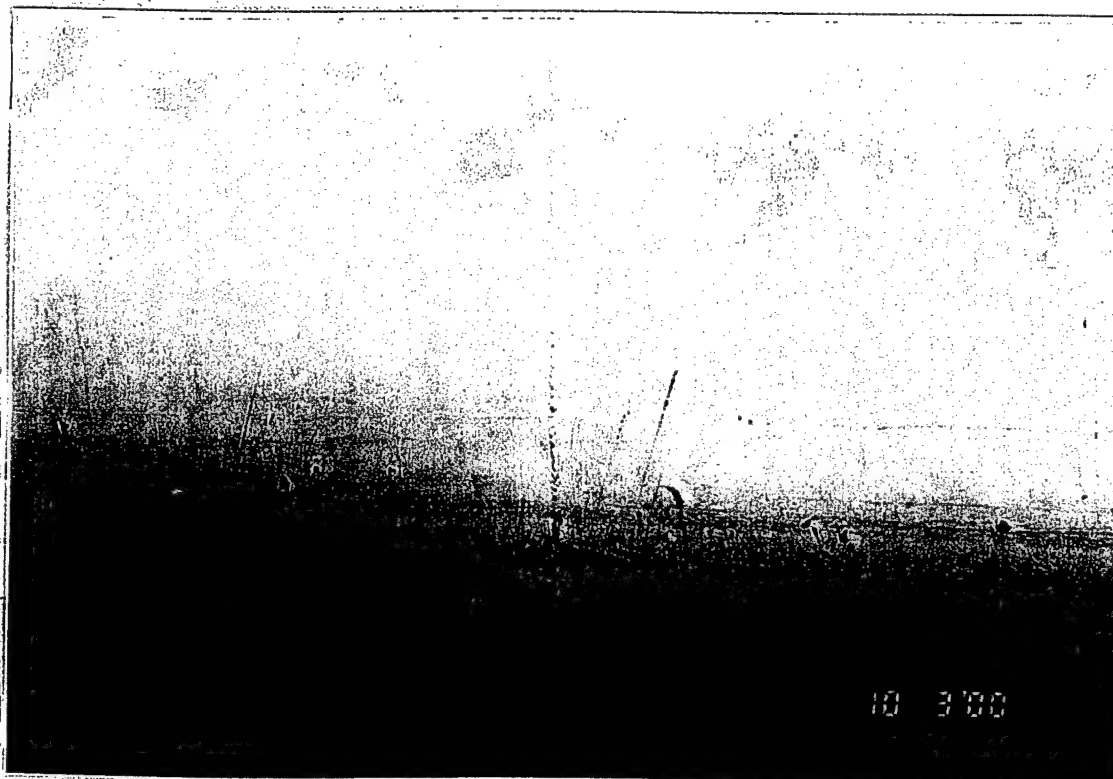
Lower  
Granite  
Dam

10/03/00

8-23

#### Gate 8

Upstream surface of skin plate and  
wear plate at normal water surface  
line.



Lower  
Granite  
Dam

10/03/00

8-24

#### Gate 8

Close-up upstream surface of skin  
plate and wear plate at normal water  
surface line. Light pitting, scratches  
and scrapes above and below water  
surface line.



Lower  
Granite  
Dam

Gate 8  
Skin plate pitting, typical.

10/03/00

8-25



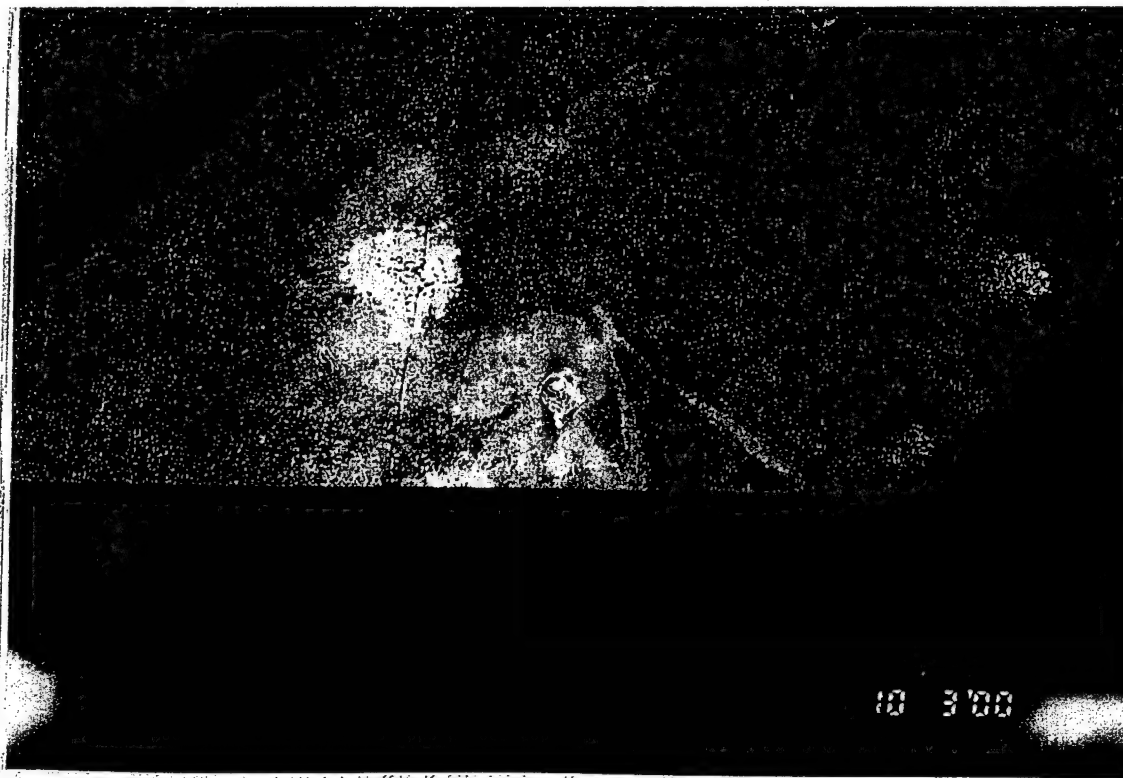
Lower  
Granite  
Dam

Gate 8  
Skin plate pitting near wear plate,  
typical.

10/03/00

8-26





Lower Gate 8  
Granite Skin plate pitting, typical.  
Dam  
10/03/00  
8-27

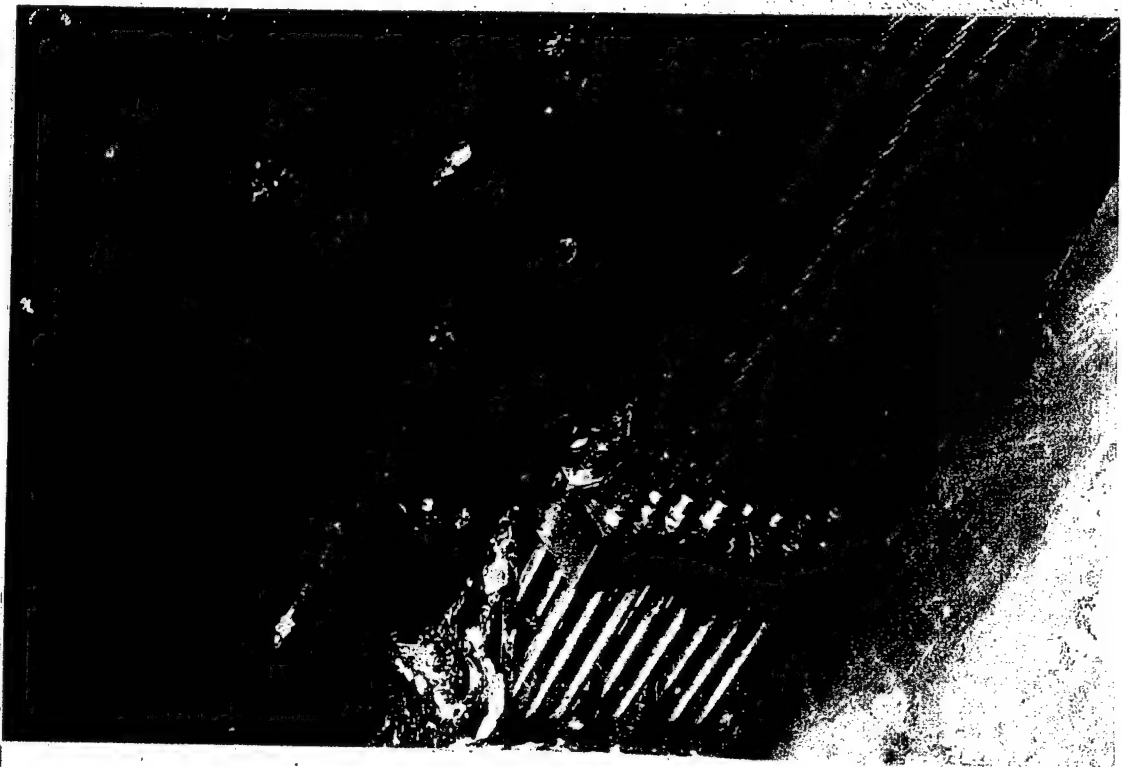


Lower Gate 8  
Granite Skin plate pitting along weld line.  
Dam  
10/03/00  
8-28



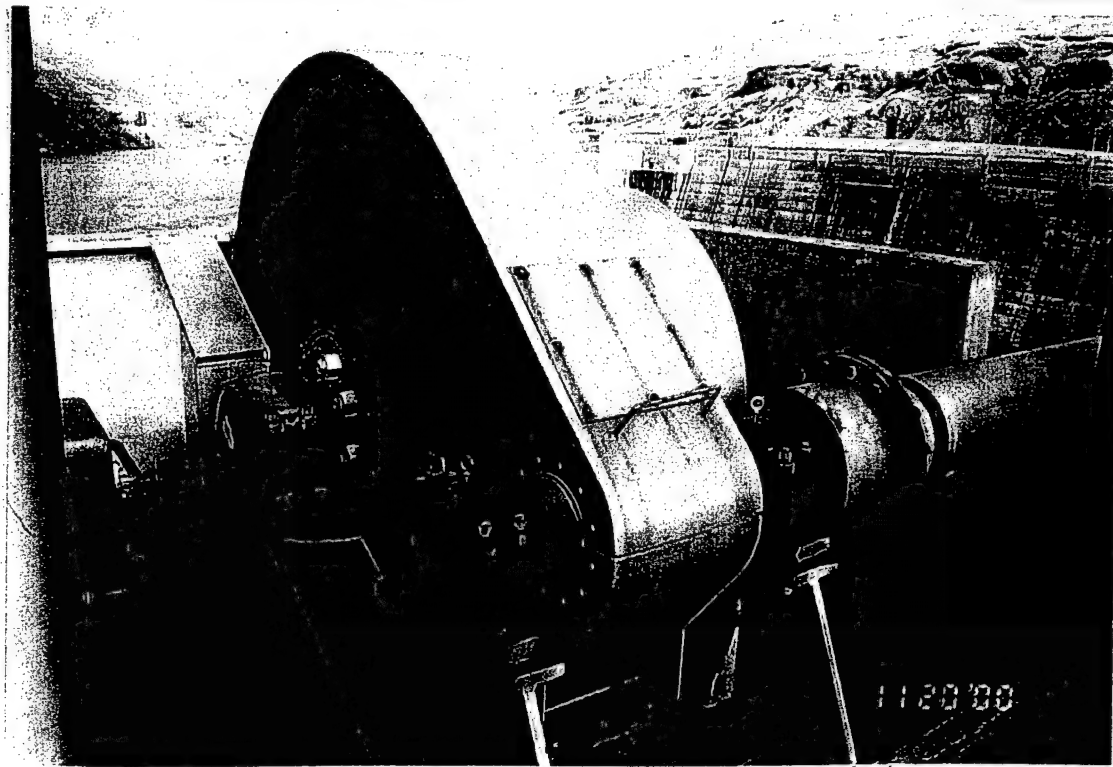
Lower Gate 8  
Granite Typical wear plate condition. Light  
Dam grooves due to cable wear, light to  
10/03/00 moderate corrosion.

8-29



Lower Gate 8  
Granite Right hoist connection. Moderate  
Dam pitting on lifting lugs and plates.  
10/03/00 Stainless steel U-bolts in good  
condition.

8-30

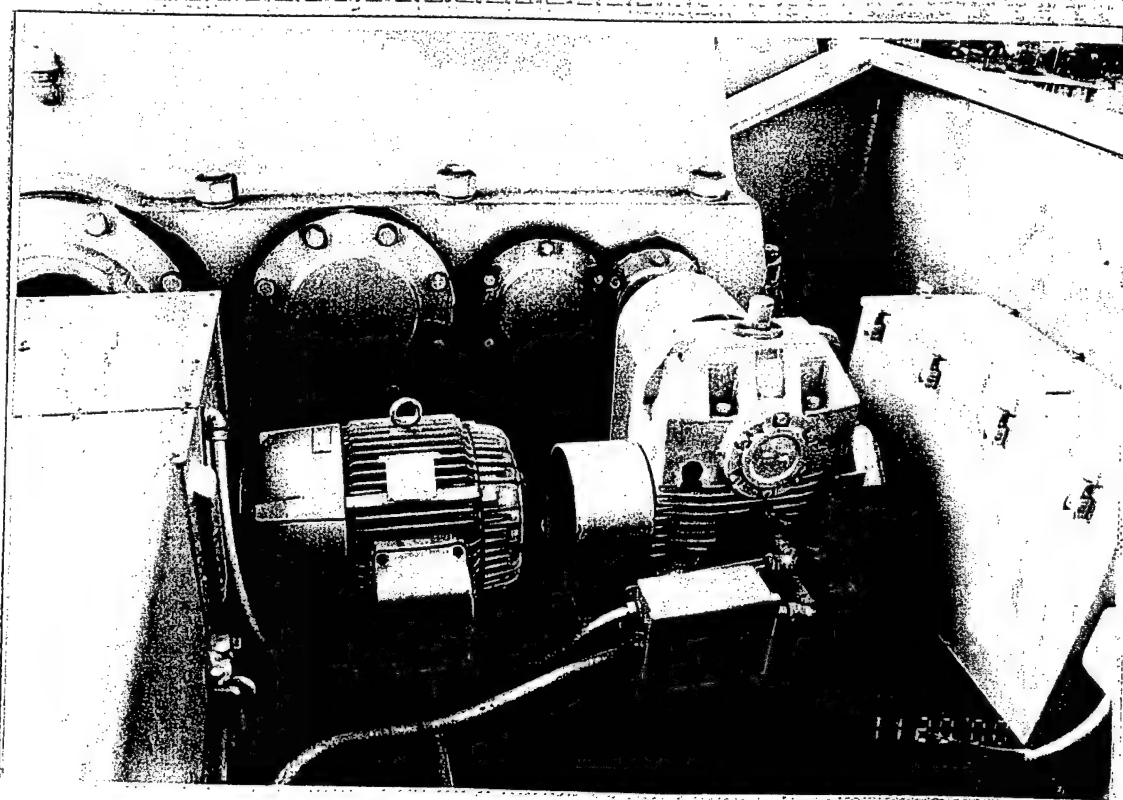


Lower  
Granite  
Dam

**Hoist & Mechanical**

Hoist, typical

M-1



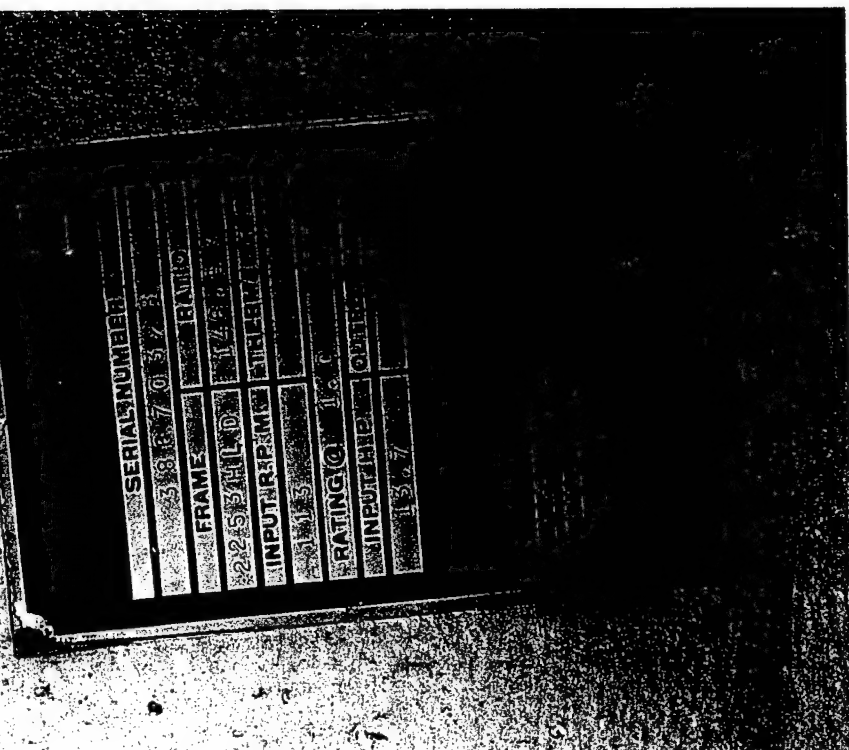
Lower  
Granite  
Dam

**Hoist & Mechanical**

Hoist motor, typical.

M-2

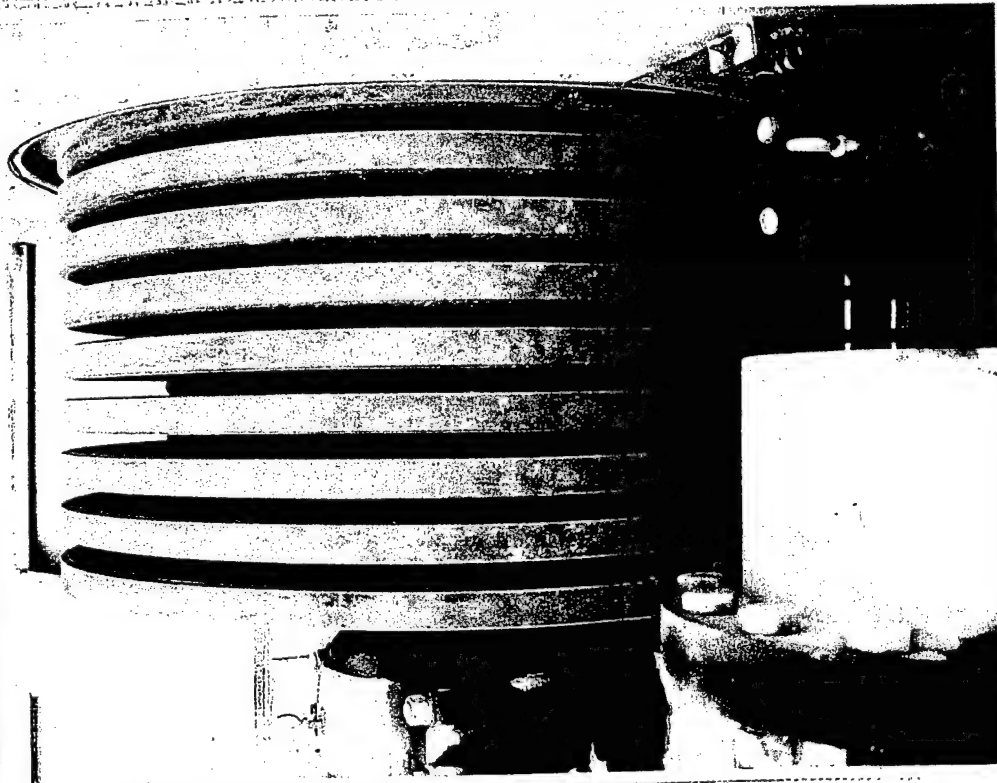
00.0211



Lower  
Granite  
Dam

**Hoist & Mechanical**  
Hoist motor name plate, typical.

M-3



Lower  
Granite  
Dam

**Hoist & Mechanical**  
Hoist drum, typical.

M-4

PROJECT NO. 100-1000  
 DRAWING NO. 100-1000-100  
 SHEET NO. 100-1000-100-100

SCALE: 1" = 10'-0"  
 1" = 10'-0"  
 1" = 10'-0"

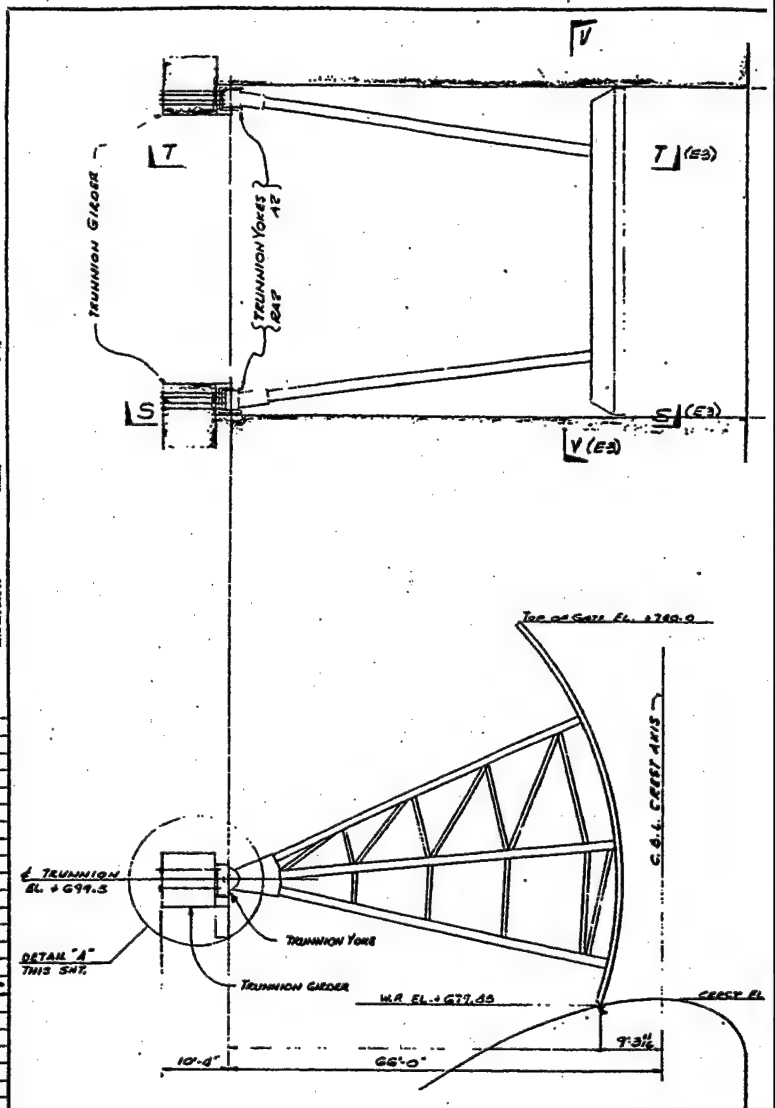
DATE: 10/1/60  
 BY: J. L. HARRIS  
 CHECKED: J. L. HARRIS  
 APPROVED: J. L. HARRIS

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

PROJECT NO. 100-1000  
 DRAWING NO. 100-1000-100  
 SHEET NO. 100-1000-100-100

SCALE: 1" = 10'-0"  
 1" = 10'-0"  
 1" = 10'-0"

DATE: 10/1/60  
 BY: J. L. HARRIS  
 CHECKED: J. L. HARRIS  
 APPROVED: J. L. HARRIS

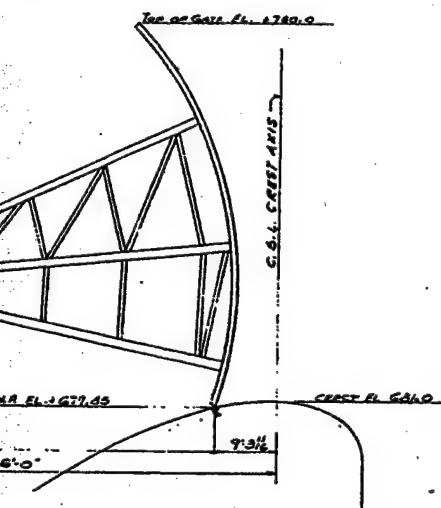
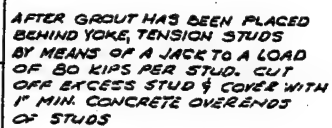


GENERAL ARRANGEMENT.  
 FOR ELEVATIONS & DETAILS SEE DWG'S E34E6

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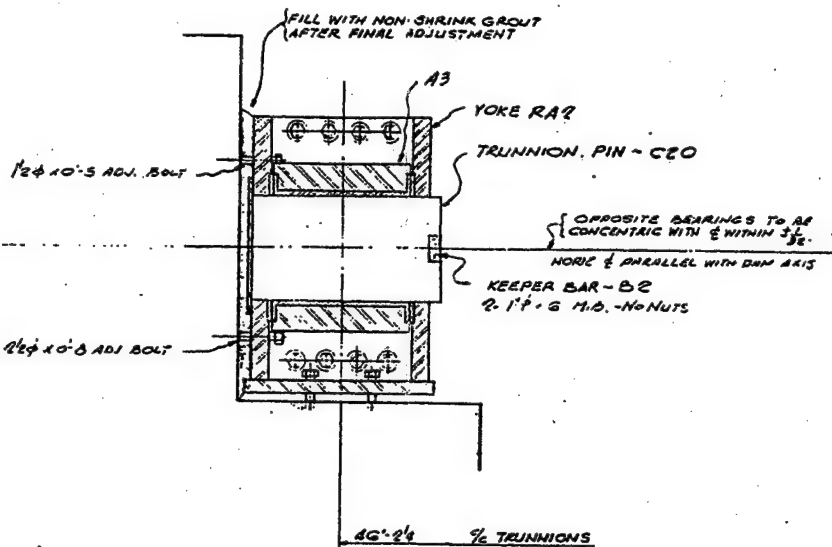
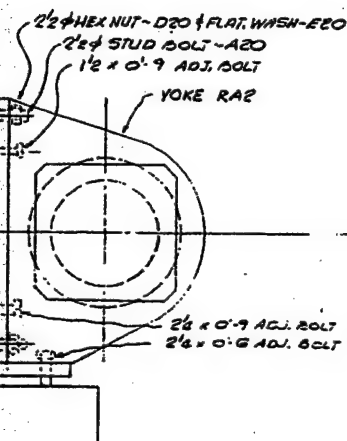
**ERECTION NOTE -**  
STRUTS, GIRDERS  
MUST BE ADEQUATELY  
PIN-UP CLIPS ARE TO HOLD  
TOGETHER DURING WELD  
CARRY THE WEIGHT OF

②

[illegible]



ACED  
S  
LOAD  
UT  
E WITH  
DS



PLACE 4" NON-SHRINK GROUT AFTER FINAL ADJUSTMENT

ERECTION NOTE -  
STRUTS, GIRDERS AND SKIN PLATE SECTIONS  
MUST BE ADEQUATELY SUPPORTED DURING ERECTION.  
PIN-UP CLIPS ARE TO HOLD THE VARIOUS SECTIONS  
TOGETHER DURING WELDING AND ARE NOT DESIGNED TO  
CARRY THE WEIGHT OF THE MEMBERS.

3

CUSTOMER'S P.O. NO.  
CUSTOMER'S DRAW. NO.

NO ITEM NUMBER 182  
CONTRACT NUMBER GACW-65-70-C-0088

APPROVAL STAMPS	
<p><b>APPROVED</b></p> <p>Subject to conditions with plans and specifications, approval of work or conditions, and to fullness of any material used, approved does not imply liability or responsibility for construction and failure.</p> <p>LOWER SNAKE RIVER RESIDENT OFFICE</p> <p>23 SEP 1953</p>	

LSR70-0088-132-004

DRAWN BY PC	DATE 12/18/50
TRACED BY	DATE
CHECKED BY CM	DATE 11-14-50
APPROVED BY	DATE

<p>STEEL CORPORATION</p> <p>12345, TULSA, OKLAHOMA 74101</p> <p>ENGINEERING DEPARTMENT</p>
--

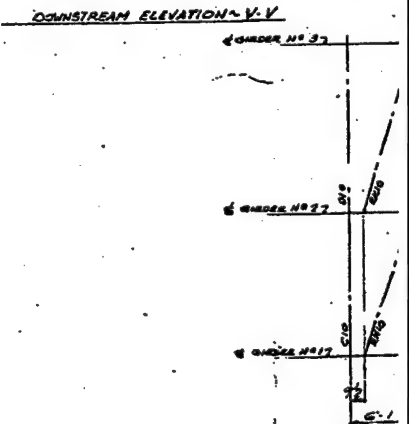
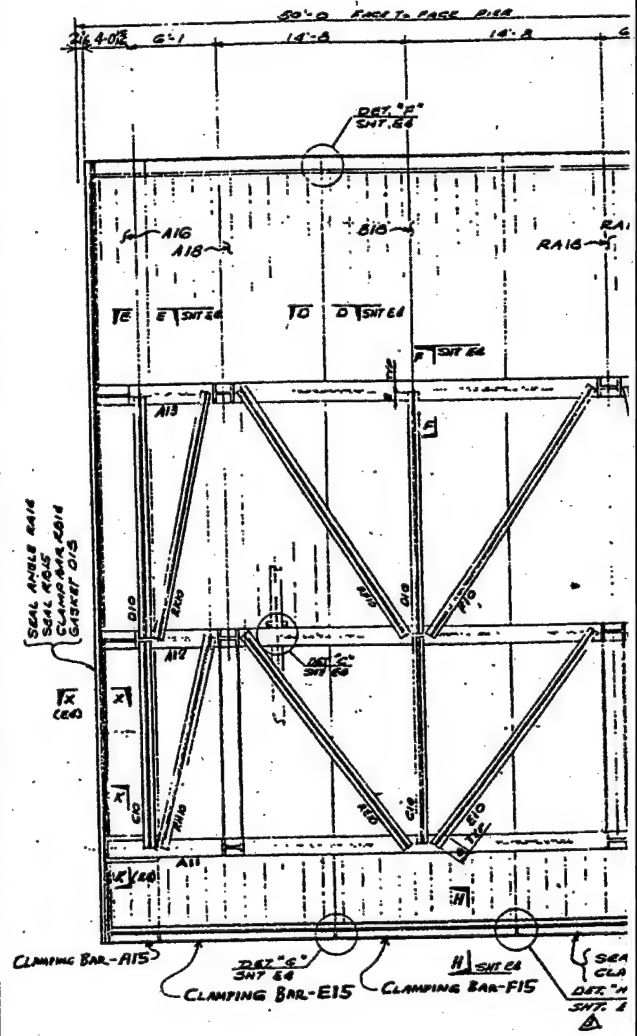
<p>SPILLING EAST-BOX ARRANGING</p> <p>LOWER GRANITE LOCK DAM</p> <p>LOWER GRANITE CONTR</p> <p>PULLMAN, WASH.</p>	<p>70-0544</p> <p>E2</p>
---	--------------------------

70-C-88-351

PROJECT NO. \_\_\_\_\_  
 DRAWING NO. \_\_\_\_\_  
 SHEET NO. \_\_\_\_\_  
 DATE \_\_\_\_\_  
 BY \_\_\_\_\_  
 CHECKED BY \_\_\_\_\_  
 APPROVED BY \_\_\_\_\_  
 TITLE \_\_\_\_\_

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

SEAL ANGLE 8416  
 SEAL ROD 805  
 CLAMPING BAR 8016  
 GASKET 015



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PROVIDER IT CONTAINS ARE THE SUBJECT'S INFORMATION. THE CONTAINER IS TO BE RETURNED TO THE OFFICE OF THE DIRECTOR OF THE FLINT AREA, OPERATIONS	HOLDS _____ UNLESS MOVED PARTNERS _____ UNLESS MOVED FROM _____	NOTES 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511
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04678  
1440



A technical diagram of a plug weld joint. Two vertical plates are shown with a central gap. A horizontal bar, labeled "ERECTOR CLIP", is positioned across the gap, passing through the plates and the weld. A bolt, labeled "1/2\" M.BOLT 10-3", is used to secure the clip. The diagram shows the clip in place before the final weld is completed. Below the diagram, the text reads: "REMOVE CLIP TO COMPLETE FIELD WELD & PLUG WELD HOLES IN WELD".

3

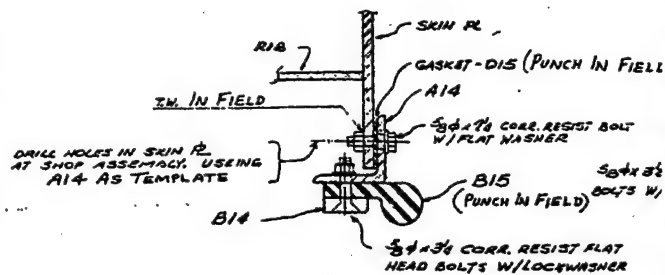
~~SECRET - NO FORN DISSEM~~

Subject to conformity with plans and specifications,  
location of covers or manholes, and the furnishing of  
the required data. Approval does not cover detail de-  
signs, or suitability for existing and future.

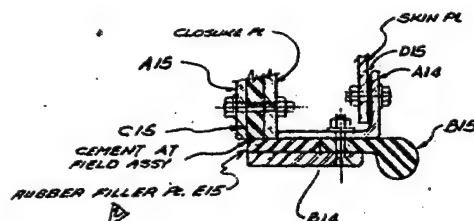
4. LOWER SHAKE RIVER  
RESIDENT OFFICE  
*[Signature]*  
25 SEP 1973

70-C-88-352

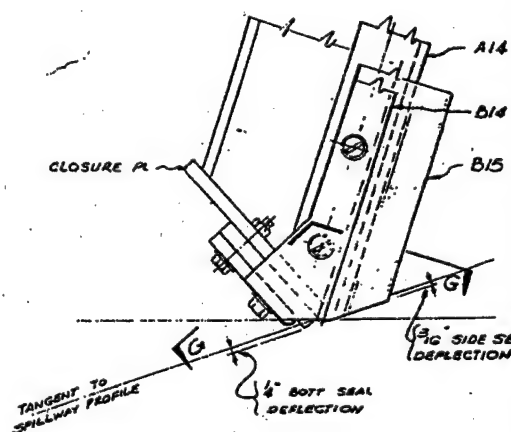
DRILL HOLES IN  
AT 3/4  
USE A15 FOR TEM



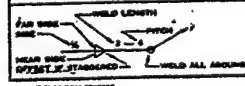
SECTION C-C - THUS  
SECTION X-X - REV.



SECTION G-G



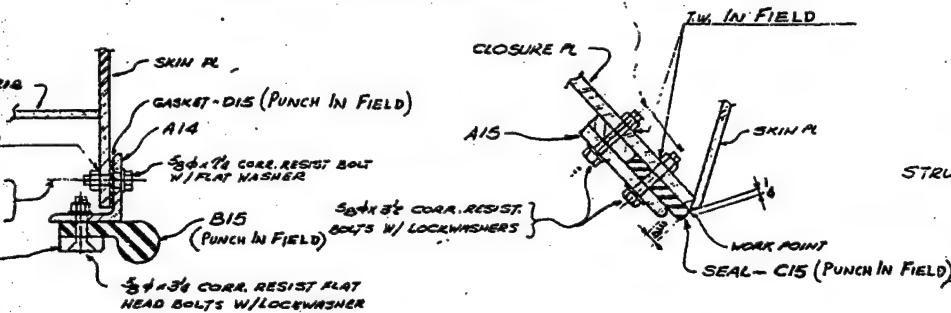
DETAIL "A"



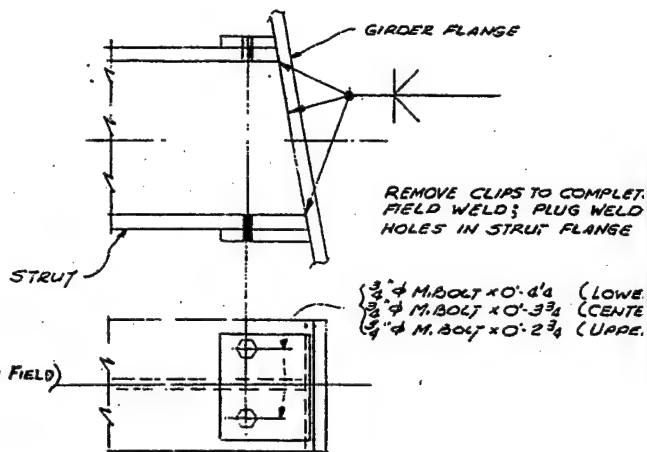
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HOLES  
FASTENERS  
TUBING

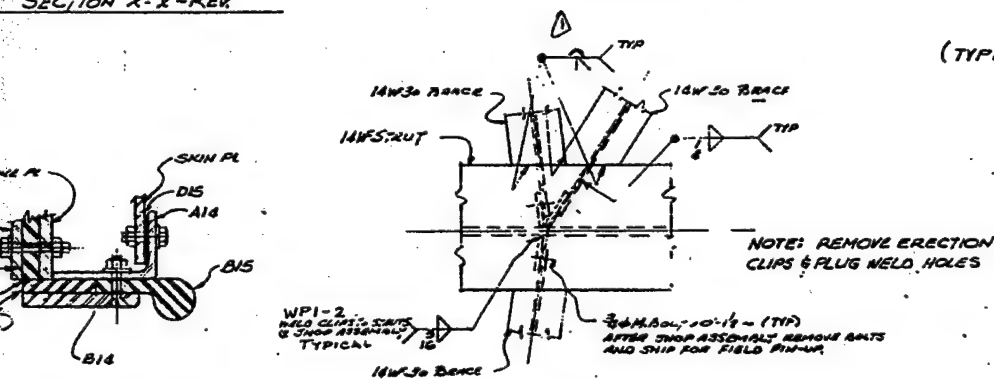
DRILL HOLES IN CLOSURE PL.  
AT SHOP ASSEMBLY.  
USE A15 FOR TEMPLATE



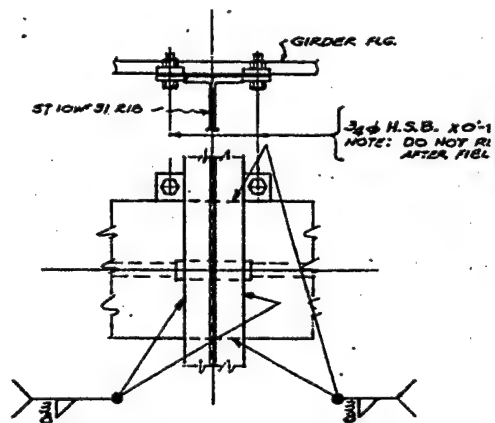
SECTION C-C - THUS  
SECTION X-X-REV.



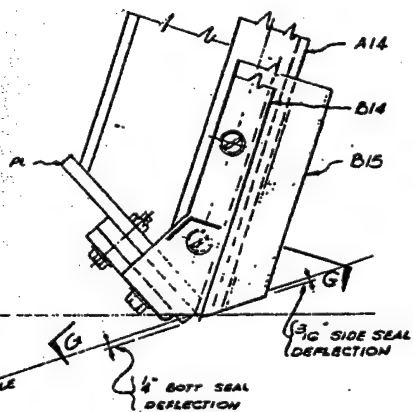
DETAIL "D"  
(TYPICAL STRUT TO GIRDER SPLICE)



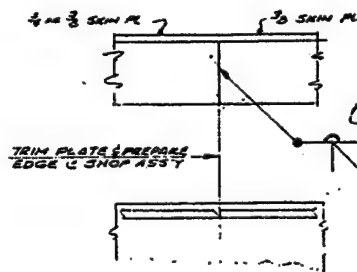
DETAIL "B"  
TYPICAL BRACE TO STEUT DETAIL



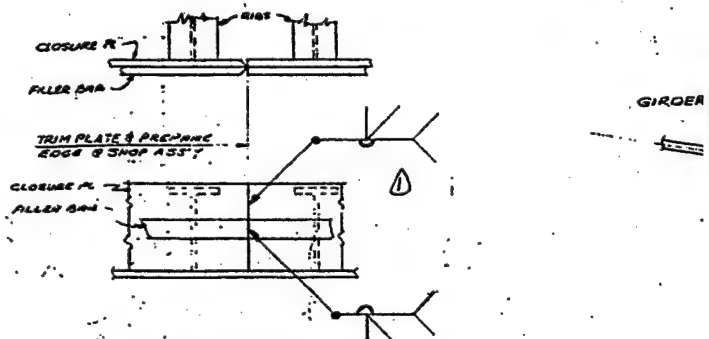
DETAIL "C"  
TYP. RIG TO GIRDER FLG.



DETAIL "A"



DETAIL "F"  
UPPER CLOSURE PL. FIELD WELD



DETAIL "G" THUS  
DETAIL "H" REV.  
LOWER CLOSURE PL. & FILLER BAR  
FIELD WELD - SEALS NOT SHOWN

(2)

ADD'D DET'L. 'A'	DESIGN NUMBER: 10-1	DATE: 10-1
CORRECT CIVIL ENGINE IN SECT. C-C & E-E	DESIGN: 10-1	DATE: 10-1
REVISED WELD SYMBOLS, PAR. LETTERS, DESIG. B-4	DESIGN: 10-1	DATE: 10-1
SHOW PL. NO. E15	DESIGN: 10-1	DATE: 10-1
REV. FOR APPROVAL, SUB. DATE 3-15-71	DESIGN: 10-1	DATE: 10-1

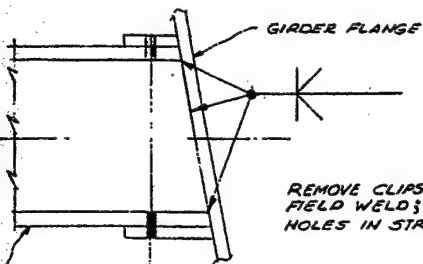
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WELDER: \_\_\_\_\_ UNLESS NOTED  
FABRICATOR: \_\_\_\_\_ UNLESS NOTED  
FINISH: \_\_\_\_\_

NOTES

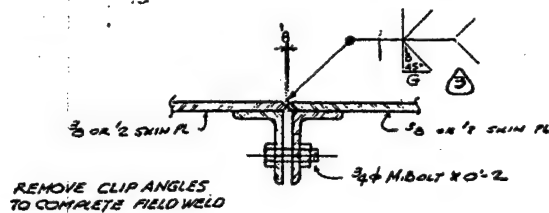
DRAWN BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
CHECKED BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
APPROVED BY: \_\_\_\_\_ DATE: \_\_\_\_\_



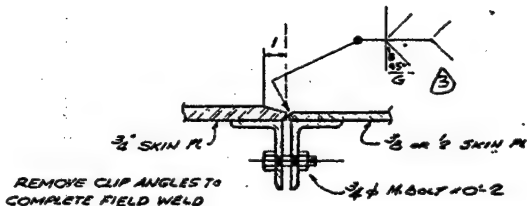


$\frac{3}{4}$ " M.BOLT  $\times 0'-4\frac{1}{4}$  (LOWER STRUT)  
 $\frac{3}{4}$ " M.BOLT  $\times 0'-3\frac{3}{4}$  (CENTER STRUT)  
 $\frac{3}{4}$ " M.BOLT  $\times 0'-2\frac{3}{4}$  (UPPER STRUT)

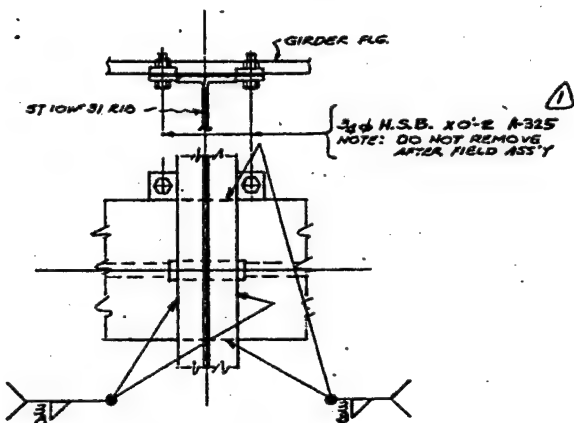
DETAIL "D"  
 TYPICAL STRUT TO GIRDER SPLICE



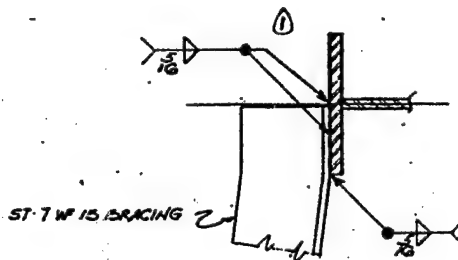
SECTION D-D  
 SKIN PL SPLICE



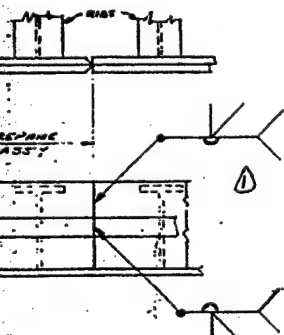
SECTION E-E  
 SKIN PL SPLICE



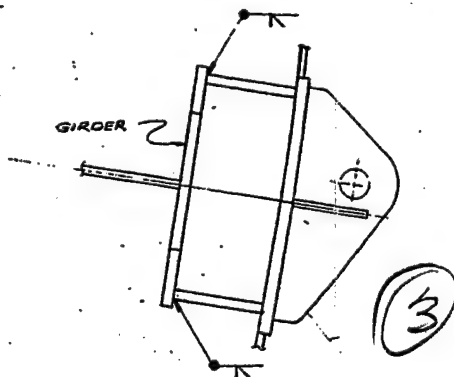
DETAIL "C"  
 TYP. RIG TO GIRDER FLG.



SECTION F-F  
 TYP BRACING CONN.



DETAIL "G" THUS  
 DETAIL "H" REV.  
 CLOSED PL & FILLER ANG  
 WELD SEAMS NOT SHOWN



SECTION K-K

DRAWING NUMBER 132  
 CONTRACT NUMBER DASH-23-70-C-0006



LSR70-0088-132-006

DATE	BY	CHKD	APP'D
12-17-70	PC	PC	PC
12-17-70	PC	PC	PC
12-17-70	PC	PC	PC
12-17-70	PC	PC	PC

DATE	BY	CHKD	APP'D
12-17-70	PC	PC	PC
12-17-70	PC	PC	PC
12-17-70	PC	PC	PC
12-17-70	PC	PC	PC

FLINT STEEL CORPORATION  
 BOX 1280, TULSA, OKLAHOMA 74101  
 ENGINEERING DEPARTMENT

SHARPE RIVER FIELD STATION  
 TOWNSHIP GRANITE LOCAL ROAD  
 LOWER GRANITE COUNTY  
 DALLAS, TEXAS

70-0566  
 E-1

70-C-88-352

MOLES \_\_\_\_\_  
FARTINGS \_\_\_\_\_  
POSSIBLE \_\_\_\_\_

[illegible]

CORR. RES. STL. 99-5-7636, CLASS FOR COND. A.

Technical drawing of a bolt circle showing top and side views with dimensions and annotations.

**Top View:** A circle with a diameter of 200 mm, labeled "200 DIA". It features eight bolt holes arranged in a circle. A dimension line indicates a 60° angle between two bolt holes. A center cross is labeled "C.S.". A dashed line with an arrow points from the text "TO GIVE 36 mm CL. BETWEEN HEAD OF BOLT & FACE" to the bolt circle.

**Side View:** A rectangular view showing the thickness of the plate. The top edge is labeled "100 DIA" and the bottom edge is labeled "100 DIA". A dimension line indicates a thickness of 10 mm. A dashed line with an arrow points from the text "TO GIVE 36 mm CL. BETWEEN HEAD OF BOLT & FACE" to the bolt circle.

**Annotations:**

- "60°" (angle between bolt holes)
- "200 DIA" (diameter of bolt circle)
- "C.S." (center of gravity)
- "100 DIA" (diameter of plate)
- "10 mm" (thickness of plate)
- "TO GIVE 36 mm CL. BETWEEN HEAD OF BOLT & FACE" (note with arrow pointing to bolt circle)

②

8-TRUNNION YOKES - THUS - A2  
8-TRUNNION YOKES - REV - RA?

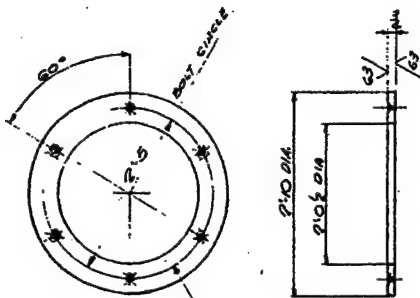
NOTE  
TAG ALL MATERIAL  
WITH ITEM NO 132

...AND INFORMATION IF CERTAIN ARE THE POSITIVE  
...FLYING STEEL COMPOSITION. THE REASON IS NOT TO BE  
...GIVEN. DEPENDS ON YOUR FOR ANY PROPER, WITH  
...THE FLIGHT COMPOSITION OF THE FLYING STEEL COMPOSITION

HOLDER \_\_\_\_\_ CHARGED NOTES \_\_\_\_\_  
 FASTENERS \_\_\_\_\_ UNLAKING NOTES \_\_\_\_\_  
 FINISH NONE

④ REVISED WARD SYMBOLS  
④ COMPLETED MAR 215  
④ CORRECTED FOR: APP, DUT  
④ REV. FOR APPROVAL. SIGNED DATED 3-15-71  
15-71

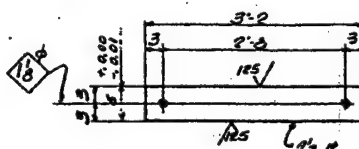
N. NAME	DRAMA-10-25-71	DRAWN BY	PC	DATE	11-2-71
BY	Page 24-24	TRACED BY		DATE	
PI	F.D. 580-17	CHECKED BY	C.M	DATE	12-22
APPROVED BY	9-6-71	APPROVED BY		DATE	



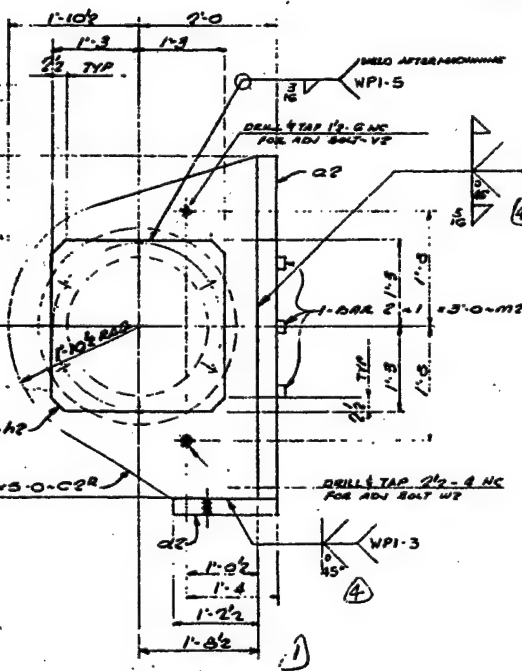
CTSK. TO GIVE  $\frac{3}{16}$  IN. CLEARANCE  
BETWEEN HEAD OF BOLT & FACE OF WASH.

### DETAIL "A" - THRUST WASHER - F2

CORR. RES. 576. QO-S-7636, CLASS 304 COND. A.



### 16-KEEPER BARS - B2



- NOTE -
- 1- WELD Q2 TO YOKER BEFORE STRESS RELIEVING
  - 2- 26 DIA. PIN HOLES TO BE LINE BORED AFTER STRESS RELIEVING
  - 3- ADD BOLT OF THRU W/ TO BE INSTALLED PRIOR TO CHIPPING SEE DWG B2
  - 4- WELDING TO BE STRESS RELIEVED BY HEAT TREATMENT AFTER WELDING IS COMPLETED, EXCEPT FOR WELDING OF R H2
  - 5- ALL MACHINING TO BE DONE AFTER WELDING IS COMPLETE EXCEPT WELDING BARS H2.

NOTE  
TAG ALL MATERIAL  
WITH ITEM NO 132

NO.	PCS.	MARK	MATERIAL	LENGTH	FT.	IN.	WEIGHT
B	A2	TRUNNION YOKER					
B	B2	TRUNNION YOKER					
1/4	16	Q2 PL. 4340 x 3/2		5	0		
1/4	16	Q2 PL. 4340 x 1		5	0		
1/4	16	Q2 PL. 4340 x 1		5	0		
1/4	16	Q2 PL. 4340 x 3		3	7 1/2		
1/4	32	Q2 PL. 36 x 1/2		3	0		
1/4	64	Q2 ONE Q x 3		0	9		
1/4	16	Q2 PL. 30 x 1/2		2	6		
1/4	32	Q2 BAR. 2 x 1		3	0		
1/4	32	Q2 2 1/2 x 1 1/2 x 1/2		0	6		
1/4	32	Q2 1 1/2 x 1 1/2 x 1/2		0	9		
1/4	32	Q2 1 1/2 x 1 1/2 x 1/2		0	9		
1/4	16	Q2 1 1/2 x 1 1/2 x 1/2		0	8		
1/4	16	Q2 1 1/2 x 1 1/2 x 1/2		0	8		
1/4	192	Q2 1 1/2 x 1 1/2 x 1/2		0	3		
1/4	192	Q2 1 1/2 x 1 1/2 x 1/2		0	3		
1/4	16	Q2 PL. 4340 x 3/2		3	2		

SHOP WELD  
3/8" FILLET 160 0 LIN. FT.  
5/16" FILLET 610 0  
1/2" 45° SIN. REV 120 0  
3" 45° DOL. REV 180 0  
3" 45° DOL. REV 67 0  
4" 45° DOL. REV 120 0

ALL MATL. ABG. LHM

NO. FROM NUMBER 132  
CONTRACT NUMBER DACW-02-70-C-0088

APPROVED  
Signature of [Name]  
Date 25 SEP 1973

LSR70-0088-132-007

SYMBOLS	BY NAME	DATE	FLINT STEEL CORPORATION	TRUNNION YOKER - SPILLWAY GATES	70-0540
OVER 6.5	BY NAME	DATE	BOX 1290, TULSA, OKLAHOMA 74101	LOWER REMOTE LIGN & DAM	
BY NAME	BY NAME	DATE	ENGINEERING DEPARTMENT	LOWER GOODWIN CANAL	
BY NAME	BY NAME	DATE		BULLMOUNT WASH	

70-C-88-353

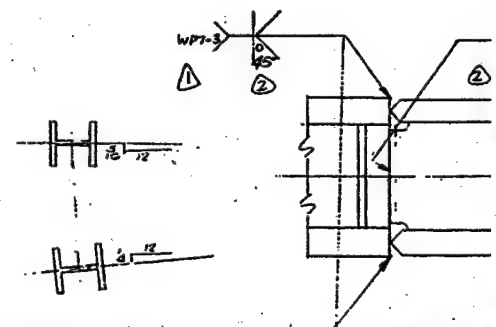
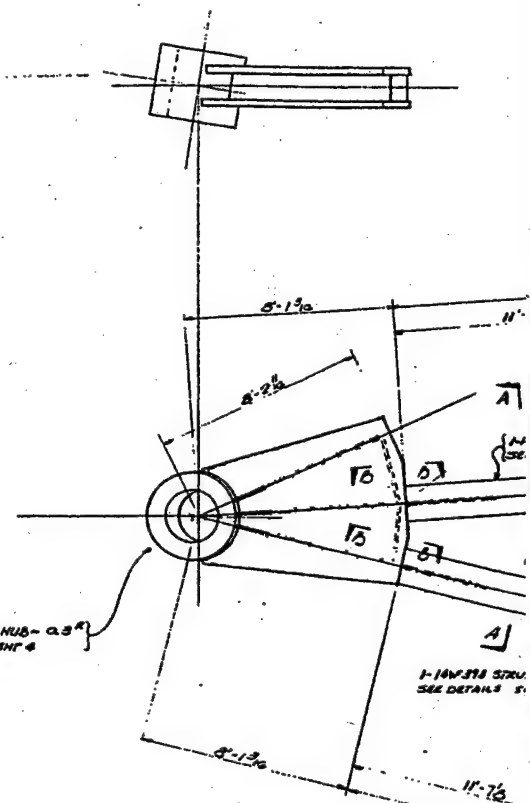
1" TRUNNION HUB - 0.3" SEE DETAILS SHIP 4  
 1" 10W.318 STRU. SEE DETAILS 5

1" TRUNNION HUB - 0.3" SEE DETAILS SHIP 4  
 1" 10W.318 STRU. SEE DETAILS 5

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

1" TRUNNION HUB - 0.3" SEE DETAILS SHIP 4  
 1" 10W.318 STRU. SEE DETAILS 5

1" TRUNNION HUB - 0.3" SEE DETAILS SHIP 4  
 1" 10W.318 STRU. SEE DETAILS 5



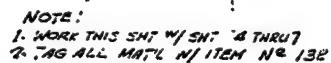
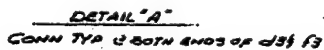
SECTION A-A  
 SECTION C-C  
 TYP. STRU. TO H

SHOP NOTE  
 PICTURE IS DRAWN  
 BUT THEY ARE NOT  
 PLANE PASSING TH  
 IS CUT ON A BEVE

WELD LENGTH  
 PITCH  
 WELD ALL AROUND  
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 WITHOUT THE WRITTEN PERMISSION OF THE PLANT OPERATOR

①





EACH ARM IS A TRUE VIEW,  
ARE TILTED SLIGHTLY TO A  
WEB ON THE LEFT END THAT  
WORKED OFF  $\frac{1}{2}$  OF WEB DEPTH

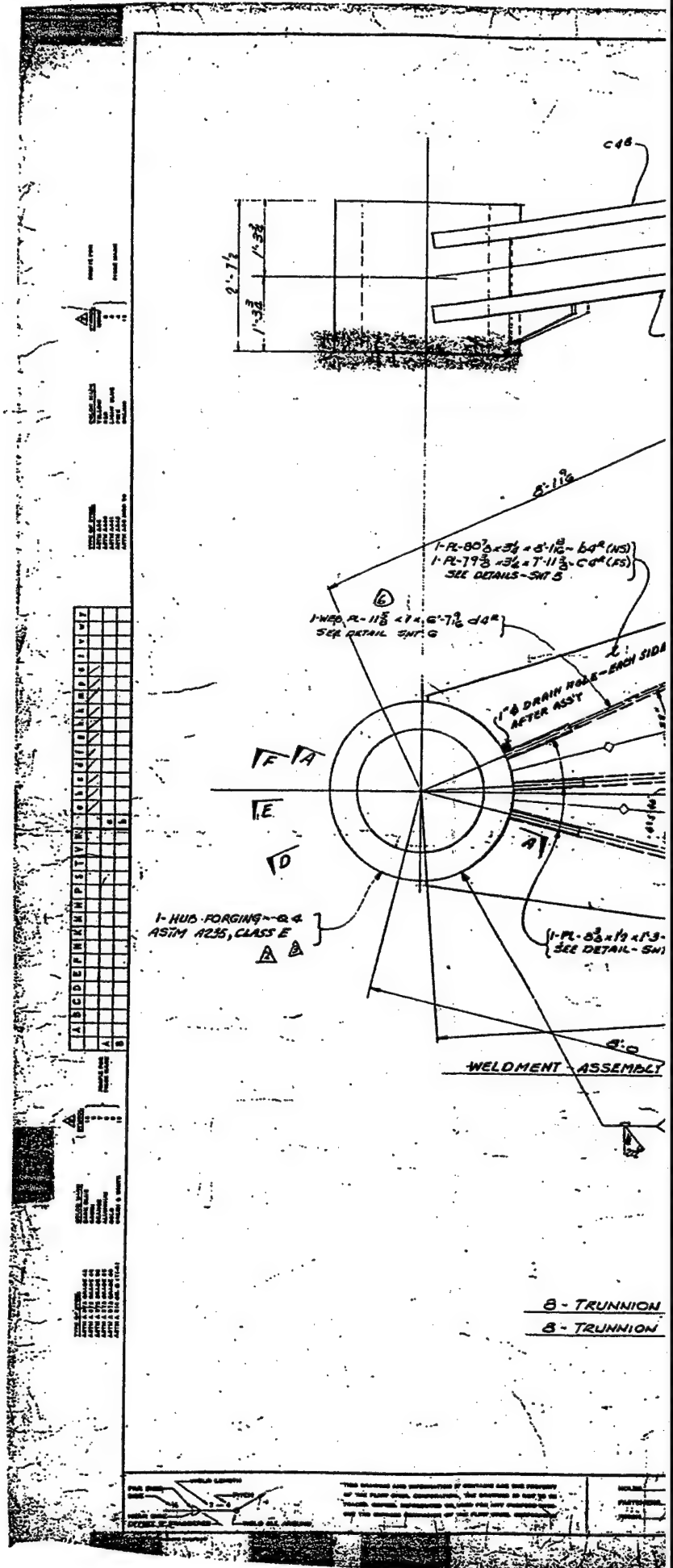
BID ITEM NUMBER 132  
 CONTRACT NUMBER DACH-68-70-C-0288

25 SEP 1972

LSR 70-0088-132-008

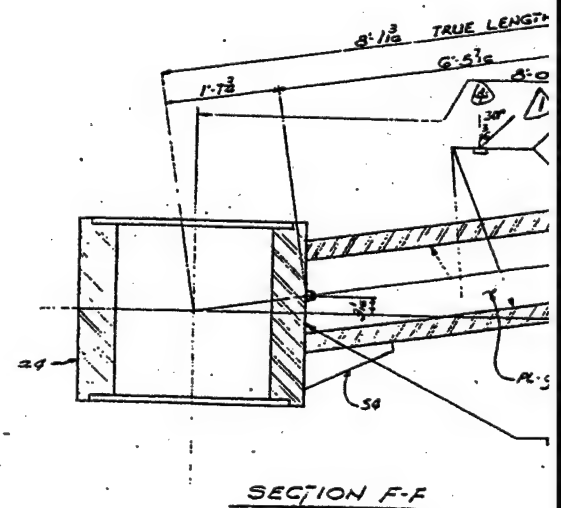
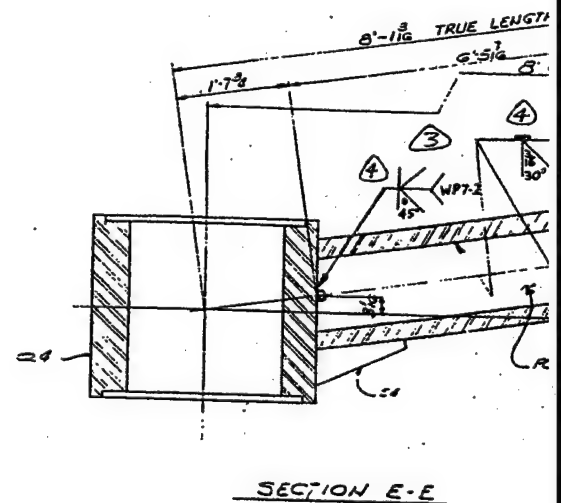
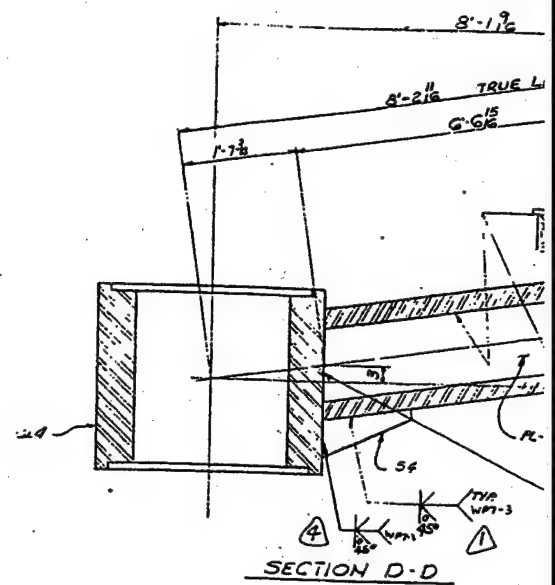
70-C-88-354





SEARCHED BY <i>PC</i>	DATE <i>11-3</i>
INDEXED BY	DATE
CLASSIFIED BY <i>C.M.</i>	DATE <i>12-52</i>

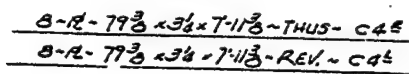
70-C-88-355

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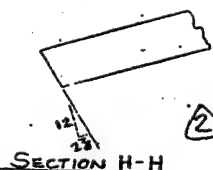
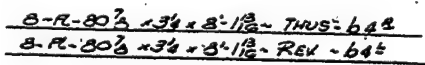
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NO. 13  
FASTENERS  
FROM Ala

PLANNED	DOCS	12-26-79	DESIGNED BY	R	DATE	12-3-79
ENGINEER		12-12-79	TRACED BY		DATE	
6. HARRIS	10-11-79		DESIGNED BY	C.M.	DATE	12-22-79
10-11-79			APPROVED BY		DATE	



~ END VIEW ~  
TYP FOR R'S 64R & 64R



BID ITEM NUMBER 132  
 CONTRACT NUMBER DAWCS G8-70-C-0088

APPROVAL STAMPS

**APPROVED**

Signed in conformity with above and recommendations  
of members of Senate of Representatives, and in testimony  
thereof, I, the undersigned, do hereby certify that the  
above is true and correct.

**LOWER SHAKA RIVER  
RESIDENT OFFICE**

\_\_\_\_\_  
*[Signature]*

Date: **23 SEP 1973**

CUSTOMER'S P.A. NO.  
CUSTOMER'S UPA. NO.

LSR70-0088-132-010

**FLINT STEEL CORPORATION**  
BOX 1280, TULSA, OKLAHOMA 74101  
ENGINEERING DEPARTMENT

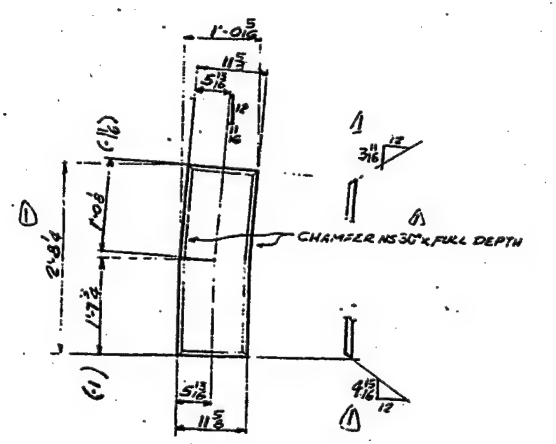
TRAINING DETAILS - TALLY WATERS  
FRESH GRAVITE LOCK & PAUL  
GRAVITE CONTAINER

70-0540

70-C-88-356

**77-9076**

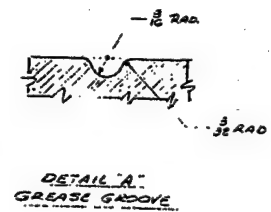
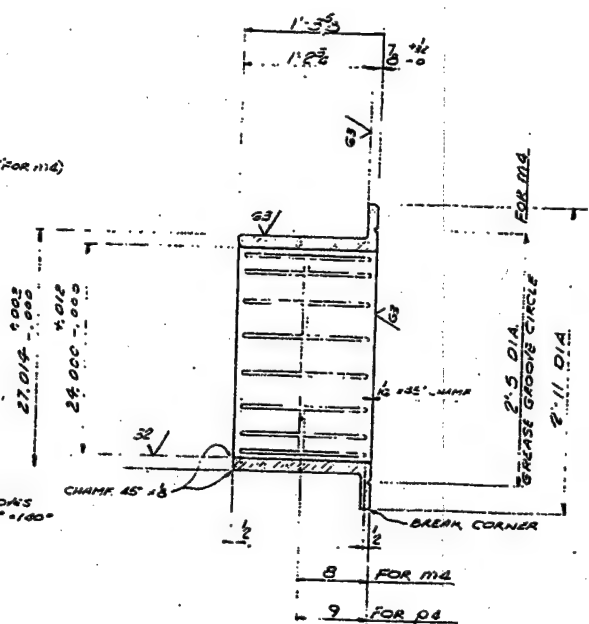
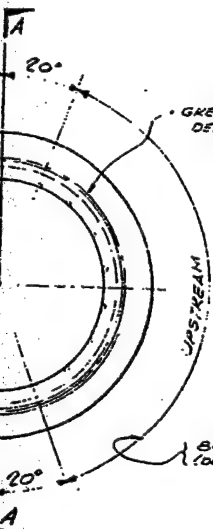
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A87N A 97B 00A00 00  
A87M A 97C 00A00 00  
A87M A 97D 00A00 00  
A87M A 97E 00A00 00  
A87M A 97F 00A00 00  
A87M A 97G 00A00 00



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--	---	---

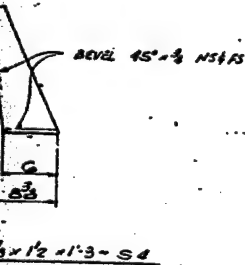






ON BUSHINGS - M16  
ON BUSHINGS - P4  
ALUMINUM BRONZE  
OO-B. 6710 CLASS 3 H.T.  
100 CLASS 9-C H.T.

SECTION A-A



3

NO ITEM NUMBER 132  
CONTRACT NUMBER DACW-68-70-C-0008

APPROVAL STAMP	
<b>APPROVED</b>	
Subject to conformity with plans and specifications, drawings of work or quantities, and in full force of any contract, the undersigned does not warrant or assume any responsibility for construction and assembly.	
LOWER SHAKE RIVER RESIDENT OFFICE By: <i>[Signature]</i> Date: 23 SEP 1978	

LSR70-0088-132-011

WORK THIS DWG W/DWG NO 3-445

DESIGNED BY: <i>EL</i>	DATE: 12-2-70
TRACED BY: <i>EL</i>	DATE: 12-22-70
CHECKED BY: <i>EL</i>	DATE: 12-22-70
APPROVED BY: <i>EL</i>	DATE: 12-22-70

FLINT STEEL CORPORATION  
BOX 1200, TULSA, OKLAHOMA 74101  
ENGINEERING DEPARTMENT

TERMINATION DETAILS  
LOWER SHAKE RIVER  
LOWER SHAKE RIVER  
PULLMAN, WASH.

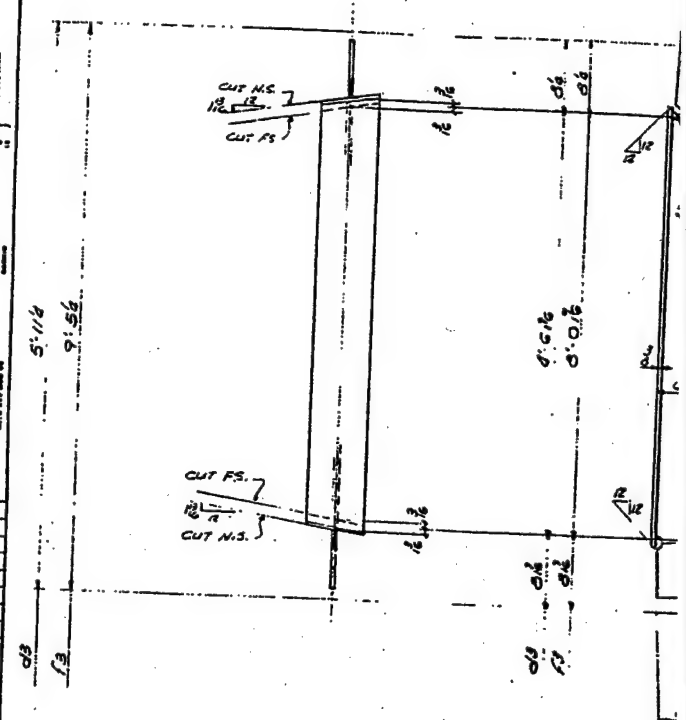
70-0548
6

70-C-88-357

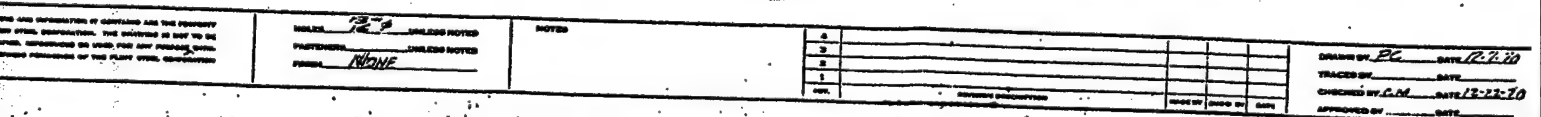
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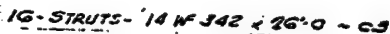
PROJECT NAME DRAWING NO. SHEET NO.		SCALE 1" = 10'-0"
DATE 10/1/56		DRAWN BY J. L. HARRIS
CHECKED BY J. L. HARRIS		APPROVED BY J. L. HARRIS

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z



- B - 16 WF 30 x 5-7 1/2 - THUS 1/2 NOTED - DB
- B - 16 WF 30 x 5-7 1/2 - REV 1/2 NOTED - DB
- B - 16 WF 30 x 7-1 3/4 - THUS 1/2 NOTED - FB
- B - 16 WF 30 x 7-1 3/4 - REV 1/2 NOTED - FB





1. WORK THIS SHT W/ SHT N# 3
2. THIS SHT DETAIL MATL - DO NOT SHIP
3. TAG ALL MATL W/ ITEM N# 132

CONTRACT NUMBER **DJCV-68-70-C-0088**

**APPROVED**  
Subject is conforming with plans and investigations  
of members of group, as evidenced, and to be  
the original work. Accepted from and other work of  
members, or accepted by the examining and forwarding  
**LOWER SNAKE RIVER  
RESIDENT OFFICE**  
Exp. *12-1-73*  
Date **25 SEP 1973**

LSR 70-0088-132-012

STRUT & BRACE DETAILS  
LOWER GRANITE LOCK & DAM  
LOWER GRANITE CONTR  
PULLMAN, WASH

JOB NO.  
78-0544  
SHEET NO.  
7

70-C-88-358

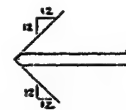
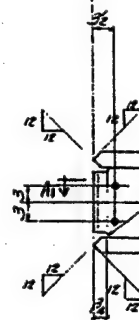
MATCH MARK W/CB (SHT 7)  
FOR CUTTING

WORK POINT DIMS FOR  
STRUT BRACING

20'-7 1/2" (14 W 348 x 20'-8 3/4")

8'-9 3/4"

11'-7 1/2"



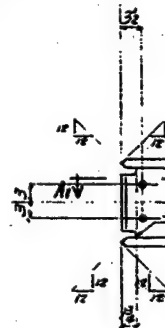
SECTION A1-A1

16- STRUTS- AB

WORK POINT DIMS FOR  
STRUT BRACING

11'-8 3/4"

11'-9 1/2"



16- S

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z

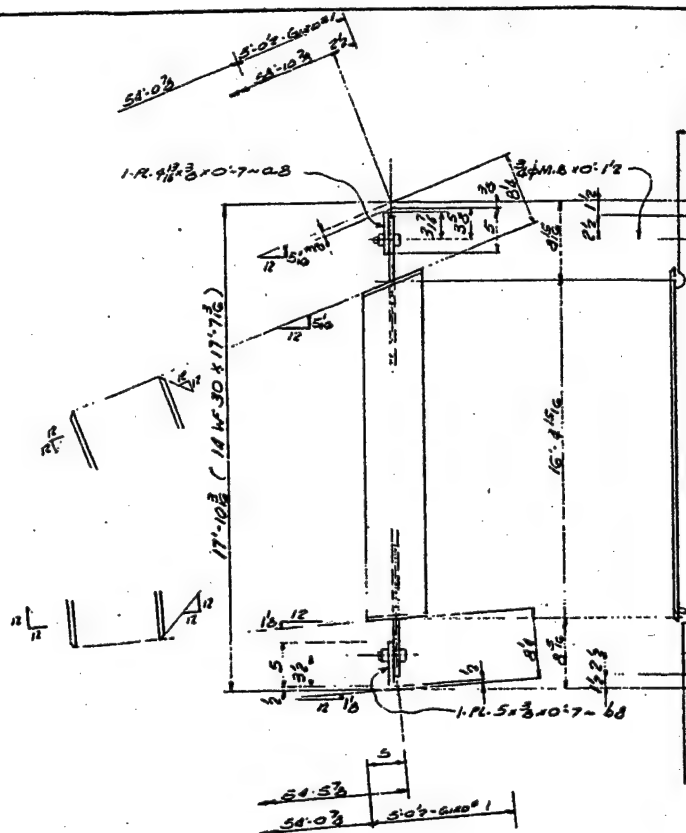


16- S

FOR WELD LENGTH  
SEE  
WELD ALL AROUND

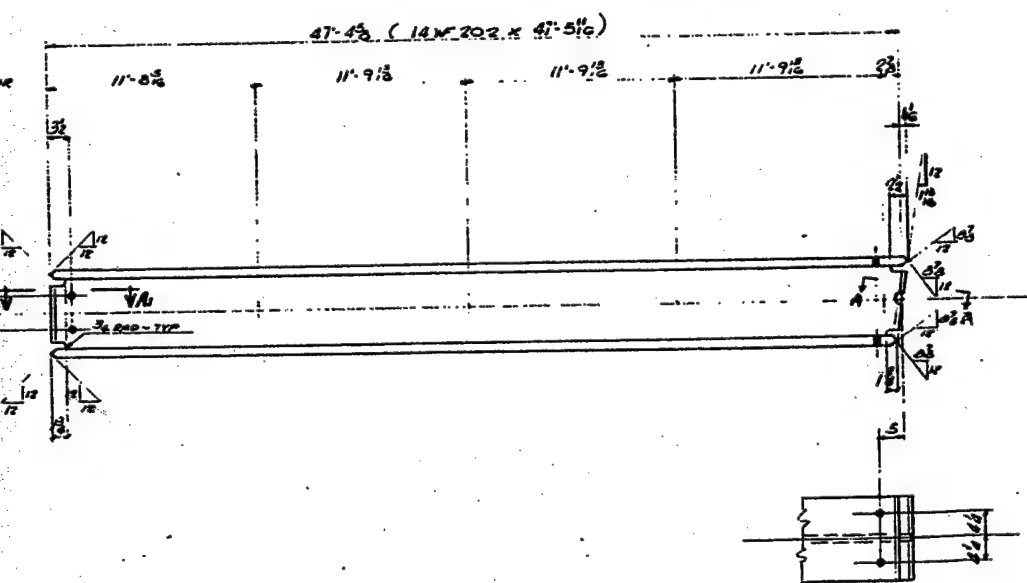
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100  
200



SEC. A-A

16- BRACES - C8



16- STRUTS - B8

2





NOTE  
TAG ALL MAT'L W/  
ITEM NR 132

**OPTIONAL STAMP**

Subject to forwarding with 5 am and week  
corrections of errors or omissions, and to full  
any required tests. Approval does not constitute  
recommendation, or accountability for conducting and for

**LOWER SNAKE RIVER  
RESIDENT OFFICE**

See                     

**85 SEP 1973**

LSR 70-0088-132-013

STRUTS & BRACES  
LOWER GRANITE LOCK & DAM  
m LOWER GRANITE CONTG  
PUGHMAN WASH.

JOB NO.  
70-2540  
SHEET NO.  
8

70-c-88-357

PROJECT NO. 10-7-09  
 DRAWING NO. 10-7-09  
 SHEET NO. 10-7-09

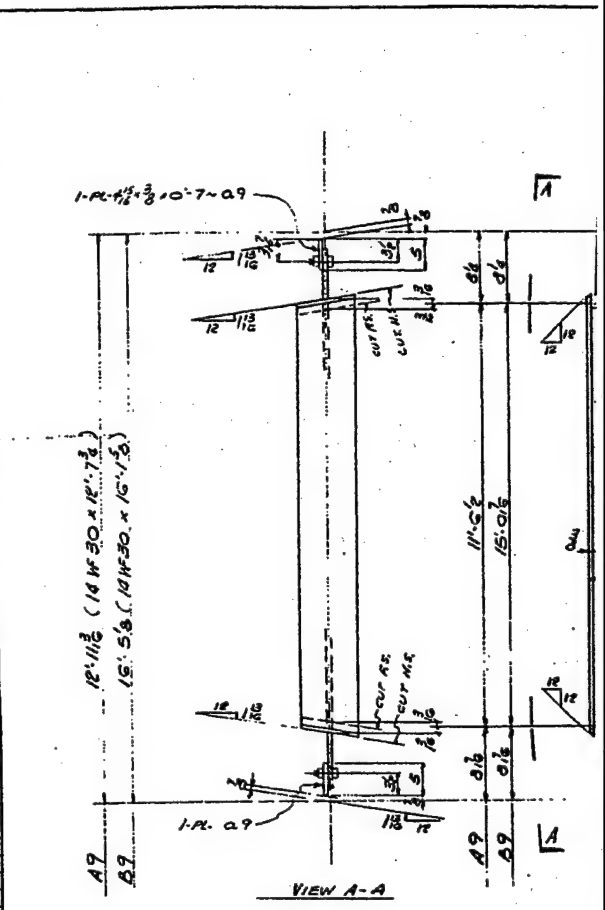
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 SECTION B-B  
 SECTION C-C  
 SECTION D-D  
 SECTION E-E  
 SECTION F-F  
 SECTION G-G  
 SECTION H-H  
 SECTION I-I  
 SECTION J-J  
 SECTION K-K  
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 SECTION N-N  
 SECTION O-O  
 SECTION P-P  
 SECTION Q-Q  
 SECTION R-R  
 SECTION S-S  
 SECTION T-T  
 SECTION U-U  
 SECTION V-V  
 SECTION W-W  
 SECTION X-X  
 SECTION Y-Y  
 SECTION Z-Z

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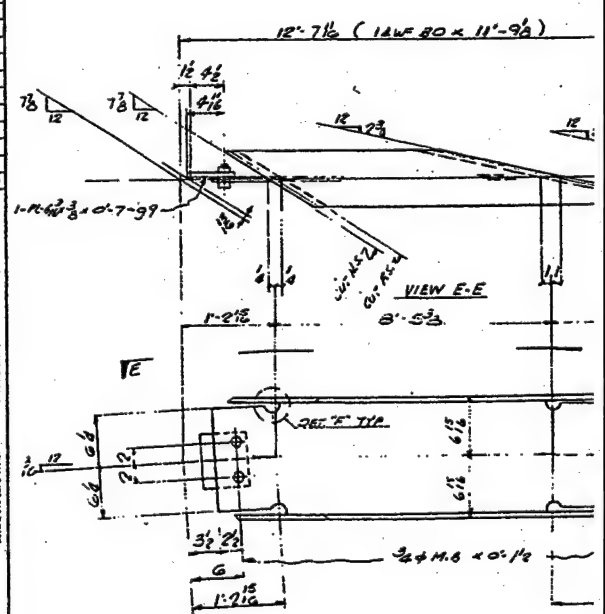
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 SECTION Z-Z

SECTION A-A  
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 SECTION Y-Y  
 SECTION Z-Z

SECTION A-A  
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 SECTION T-T  
 SECTION U-U  
 SECTION V-V  
 SECTION W-W  
 SECTION X-X  
 SECTION Y-Y  
 SECTION Z-Z



8 - BRACES - THUS & NOTED - A9  
 8 - BRACES - REV & NOTED - RA9  
 8 - BRACES - THUS & NOTED - B9  
 8 - BRACES - REV & NOTED - RB9

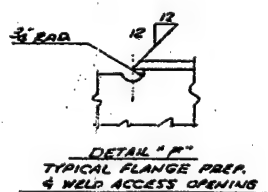
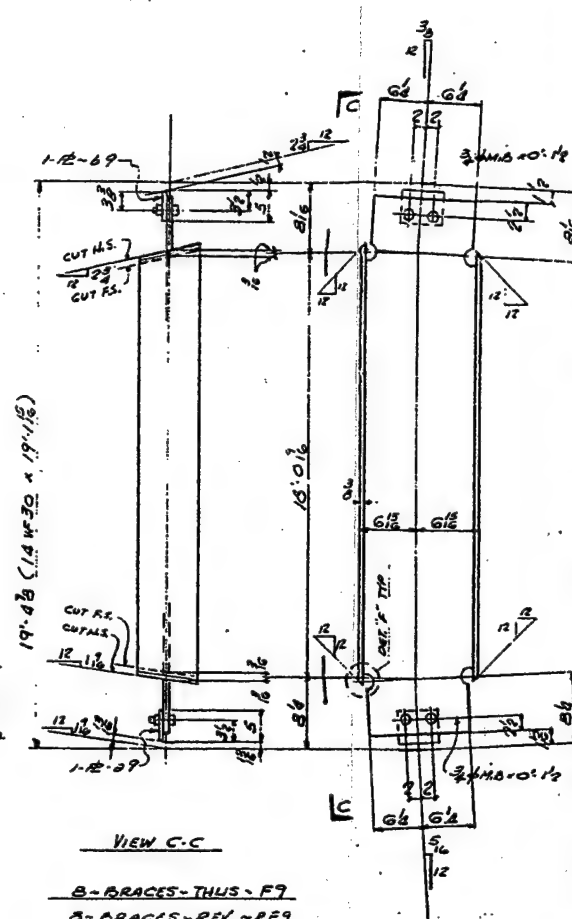


8 - DIAGONAL BRACES - THUS - H9  
 8 - DIAGONAL BRACES - REV - RH9

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1





NOTE  
TAG ALL MAT'L WITH  
ITEM N2 132

[illegible]

SIG ITEM NUMBER 132  
CONTRACT NUMBER OACH 68-70-C-0003

APPROVAL STAMP:

APPROVED

Subject to consistency with State and local laws,  
transmission of copies on requisition, and 10% of any  
of any required funds. Requested data shall remain the  
property of, and responsibility for assembling and transmitting

**LOWER SNAKE RIVER  
RESIDENT OFFICE**

By [Signature]  
85 SEP 1973

CUSTOMER'S P.O. NO.  
CUSTOMER'S PHONE NO.

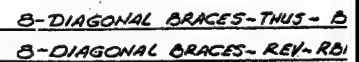
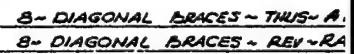
LSR 70-0088-132-014

**FLINT STEEL CORPORATION**  
BOX 1288, TULSA, OKLAHOMA 74101  
**ENGINEERING DEPARTMENT**

TRUNNION ARM BRACING  
LOWER GRANITE LOSE 4 QM  
LOWER GRANITE CONTR  
PULLMAN, WASH

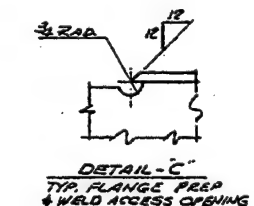
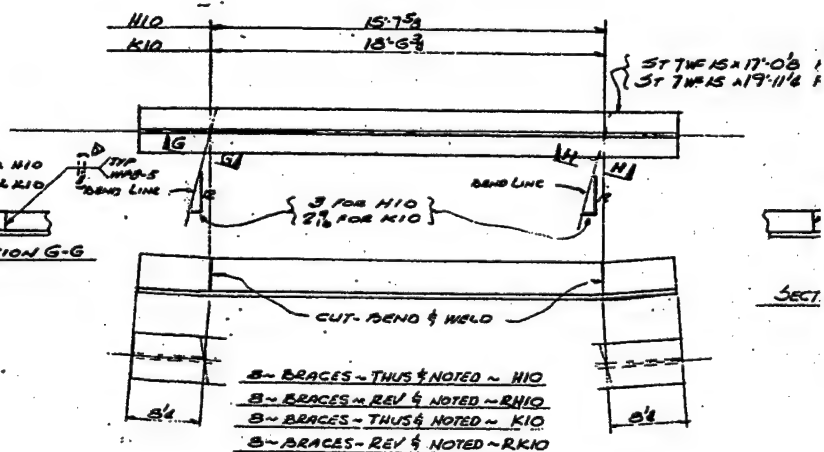
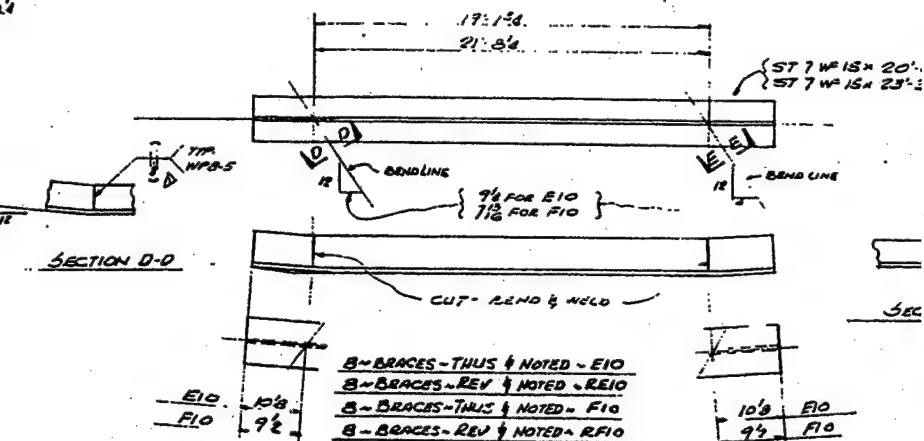
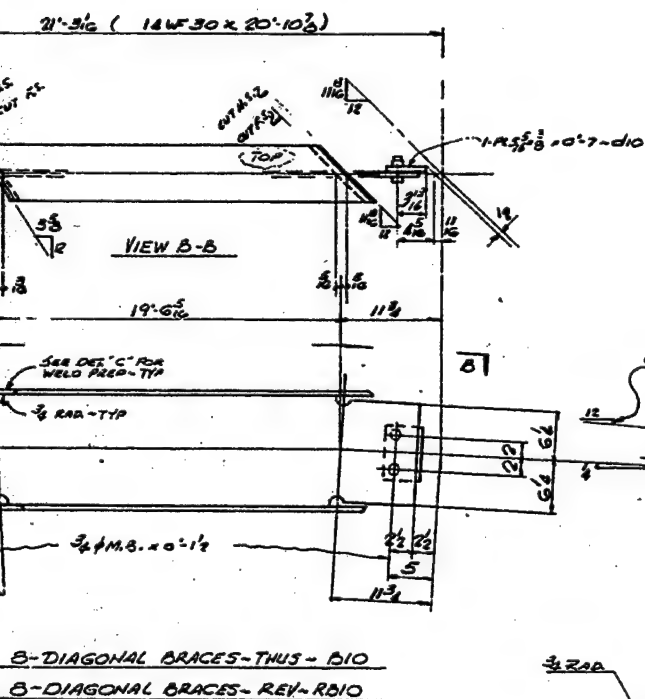
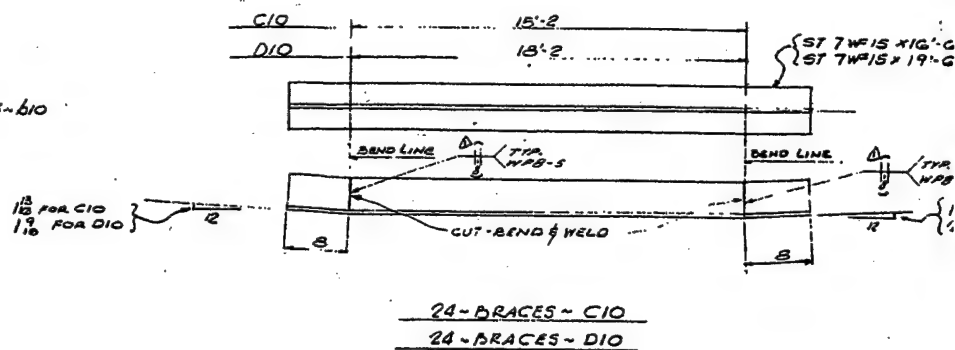
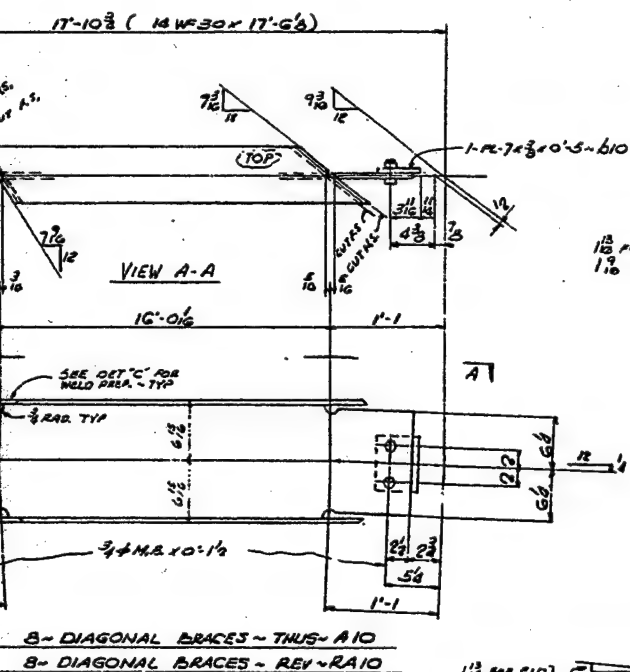
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70-0544	
SHEET NO.	REV.
9	

70-C-88-360

[illegible][illegible]

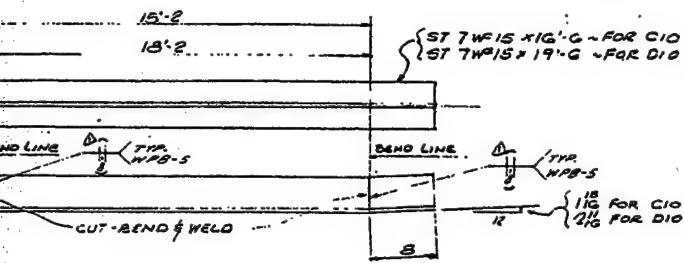
THIS DRAWING AND INFORMATION IT CONTAINS ARE THE PROPERTY OF THE PLANT STEEL CORPORATION. THE DRAWING IS NOT TO BE REPRODUCED, COPIED, REPRODUCED OR USED FOR ANY PURPOSE WITH- OUT THE EXPRESS PERMISSION OF THE PLANT STEEL CORPORATION

HOLTS 2  
 PASTORS 1  
 PAGES 1



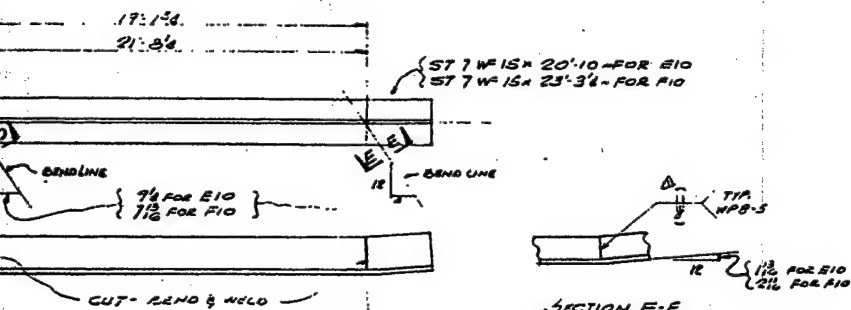
2

AND INFORMATION BY, SYSTEMS AND THE PROPERTY OF THE COMPANY. THE COMPANY IS NOT TO BE RESPONSIBLE FOR ANY LOSS OR DAMAGE TO THE PROPERTY OF THE COMPANY.		13/16" UNLESS NOTED FASTENERS UNLESS NOTED FROM NAME	NOTES	4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100	DRAWN BY: PC DATE: 12-6-70 TRACED BY: DATE: CHECKED BY: CM DATE: 12-22-70 APPROVED BY: DATE:
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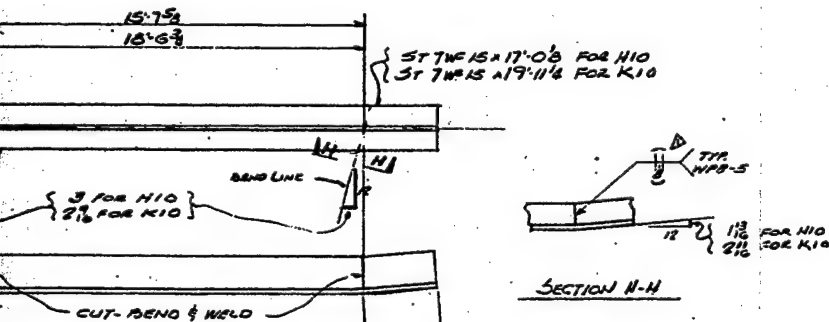


24-BRACES - C10

24-BRACES - D10



B-BRACES-THUS & NOTED - E10  
B-BRACES-REV & NOTED - RE10  
B-BRACES-THUS & NOTED - F10  
B-BRACES-REV & NOTED - RF10



B-BRACES-THUS & NOTED - H10  
B-BRACES-REV & NOTED - RH10  
B-BRACES-THUS & NOTED - K10  
B-BRACES-REV & NOTED - RK10

NOTE  
TAG ALL MATERIAL  
WITH ITEM N° 132

NO. PCL	MARK	MATERIAL	LENGTH FT. IN.	REMARKS	WEIGHT
8	A10	14WF30	17 6/8		320
8	B10	14WF30	17 6/8		320
16	C10	PL 5/8 x 3/4	0 7		3/4
16	D10	PL 1 x 3/4	0 5		4/4
64		3/4 x 1/2	0 1/2		
8	B10	14WF30	20 10/8		320
8	B10	14WF30	20 10/8		320
16	C10	PL 5/8 x 3/4	0 7		3/4
16	D10	PL 1 x 3/4	0 7		4/4
64		3/4 x 1/2	0 1/2		
24	C10	ST 7WF15	16 6	BEND 1/4	
24	D10	ST 7WF15	19 6	BEND 1/4	
8	E10	ST 7WF15	20 10	BEND 1/4	
8	B10	ST 7WF15	20 10		320
8	F10	ST 7WF15	23 3/4		320
8	B10	ST 7WF15	23 3/4		320
8	H10	ST 7WF15	17 0/8	BEND 1/4	
8	B10	ST 7WF15	17 0/8		320
8	K10	ST 7WF15	19 11/4		320
8	B10	ST 7WF15	19 11/4		320
4		4 BUTT WELD GS	0		

NO ITEM NUMBER 132

CONTRACT NUMBER DACH-68-10-C-0088

APPROVAL STAMPS

APPROVED  
SUBJECT TO THE TERMS AND CONDITIONS OF THE CONTRACT AND THE AGREEMENT OF THE CLIENT AND THE CONTRACTOR.  
LOWER SNAKE RIVER  
RESIDENT OFFICE  
SEP 25 1973

3

LSR 70-0088-132-015

DESIGNED BY PL DATE 12-8-70  
CHECKED BY C.M. DATE 12-22-70  
APPROVED BY DATE

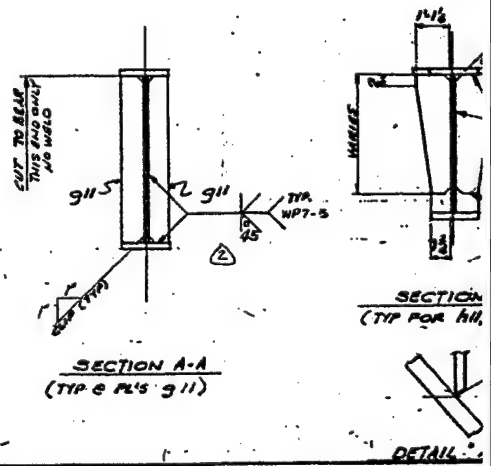
FLINT STEEL CORPORATION  
BOX 1384, TULSA, OKLAHOMA 74101  
ENGINEERING DEPARTMENT

TRINICION ARM BRACING  
LOWER SNAKE RIVER LOCK & DAM  
LOWER SNAKE RIVER  
PULLMAN, WASH.

JOB NO. 70-0544  
SHEET NO. 10

70-C-88-361





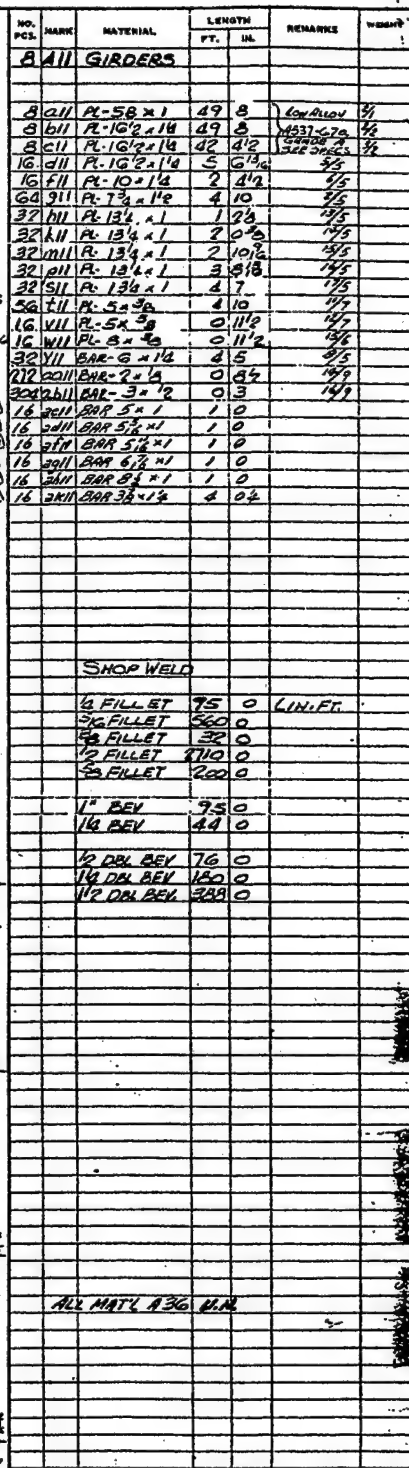
SECTION A-A  
(TYPE PL'S 911)

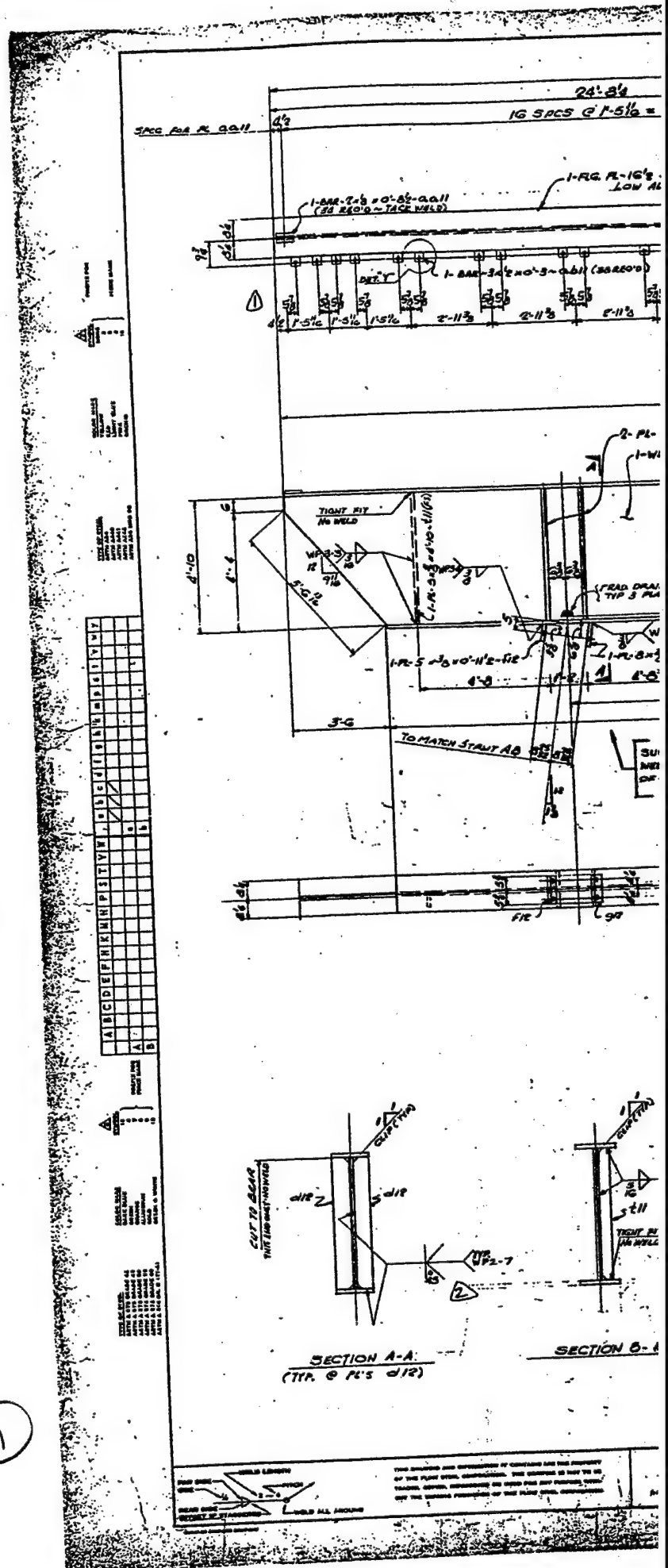
SECTION  
(TYP FOR ALL)

**DETAIL**

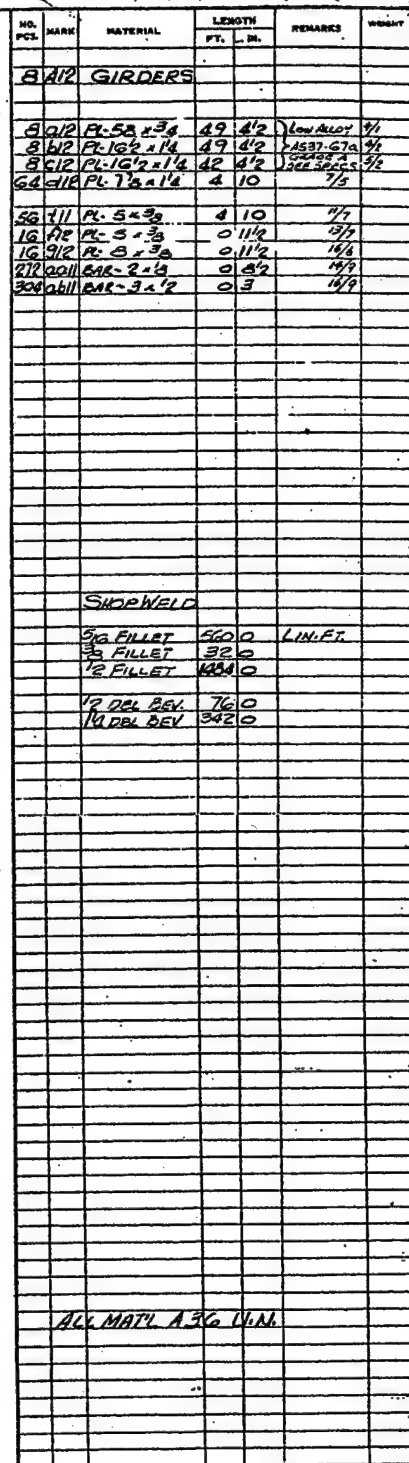
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ALL MAT'L A36 U.N.

APPROVAL STAMPS

APPROVED

Substantive agreement was reached upon inspection of documents submitted in support of the application for the proposed new program. The proposed program is hereby approved. It is recommended that the proposed program be implemented as soon as possible.

LOWER SNAKE RIVER  
RESIDENT OFFICE

Sgt. [Signature]

23 SEP 1970

**CUSTOMER'S P.O. NO.**

GIRDER N°2  
LOWER GRANITE LOCK & DAM  
LOWER GRANITE CONTR.  
PULPIT WASH.

70-0546  
SHEET NO.  
12

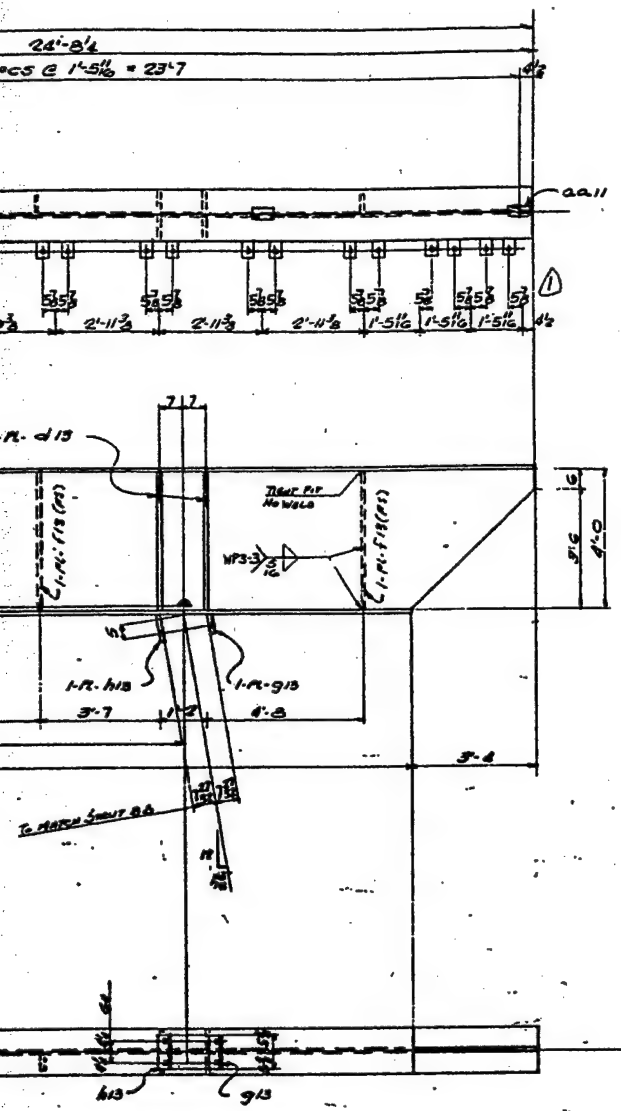
70-c-88-364











NO. PCL.	MARK	MATERIAL	LENGTH		REMARKS	WEIGHT
			FT.	IN.		
A13 GIRDERS						
B Q13	R.	48 x 7 1/2	49	2 1/2	LOW ALLOY	1/1
B L13	R.	16 x 1 1/2	49	4 1/2	A537-47	1/2
B C13	R.	16 x 7 1/2	42	8 1/2	A537-47	1/2
64-113	R.	7 1/2 x 3 1/2	40			1/2
56-113	R.	5 x 3 1/2	40			1/2
16-913	R.	5 1/2 x 3 1/2	0	11 1/2		1/2
16-113	R.	7 1/2 x 3 1/2	0	11 1/2		1/2
32-113	R.	3 1/2 x 1/2	0	3 1/2		1/2
22-113	R.	3 1/2 x 1/2	0	3 1/2		1/2
SHOP WELD						
516	FILLET		1940	0		
33	FILLET		32	0		
12	DR. BEV		76	0		
31	DR. BEV		283	0		
ALL MAT'L A36 U.S.A.						

NOTE  
TAG ALL MATERIAL  
WITH ITEM NO 132

3

ITEM NUMBER 132  
CONTRACT NUMBER DFCW G6-70-0088

APPROVAL STAMP  
**APPROVED**  
LOWER SHAKE RIVER  
RESIDENT OFFICE  
By: [Signature]  
Date: 25 SEP 1970

LSR70-0088-132-018

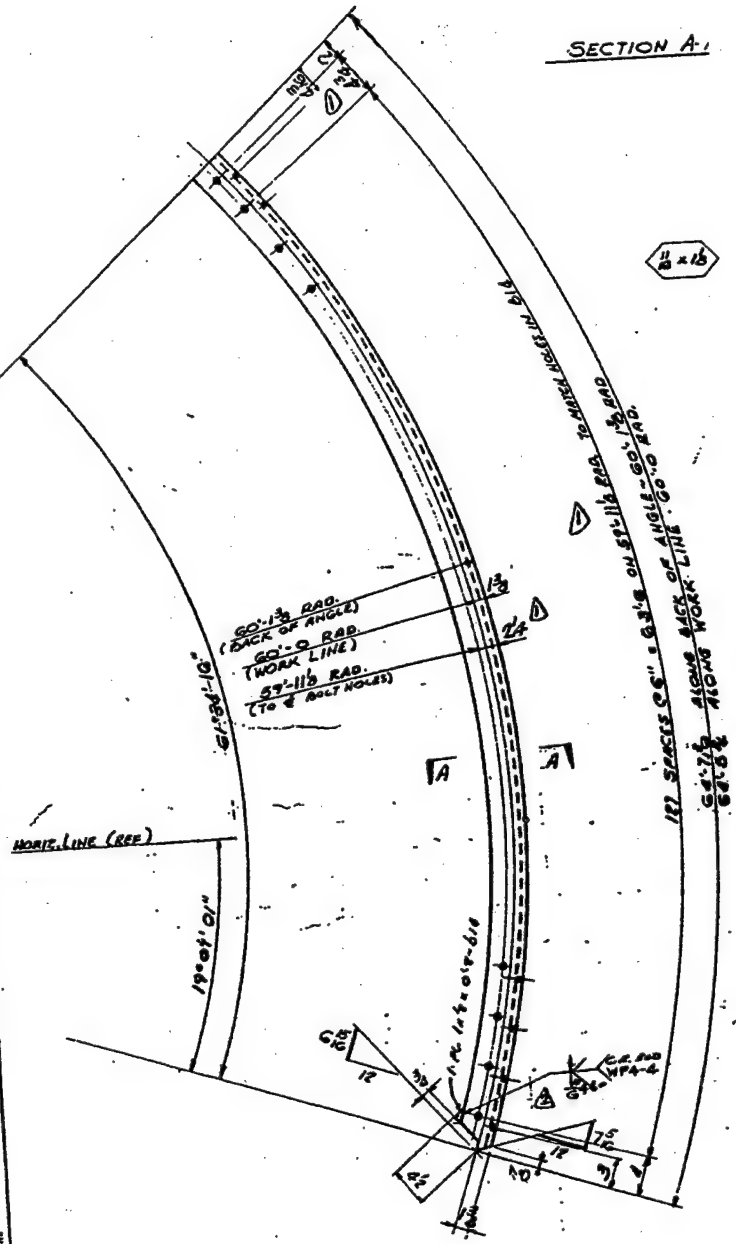
DRAWN BY: [Signature] CHECKED BY: [Signature] DATE: 12-10-70 SCALE: 1/2" = 1'-0"	<b>FLINT STEEL CORPORATION</b> BOX 1288, TULSA, OKLAHOMA 74101 ENGINEERING DEPARTMENT	<b>GIRDER No. 3</b> LOWER GRANITE LOCK & DAM LOWER GRANITE CANAL FAYATMAN, ARIZONA	JOB NO. <b>70-0544</b> SHEET NO. <b>13</b>
---	---	---	---

70-C-89-365



SECTION A1

1/8" x 1/8"



B - SIDE SEAL ANGLES - THUS - A14  
B - SIDE SEAL ANGLES - REV - RA14

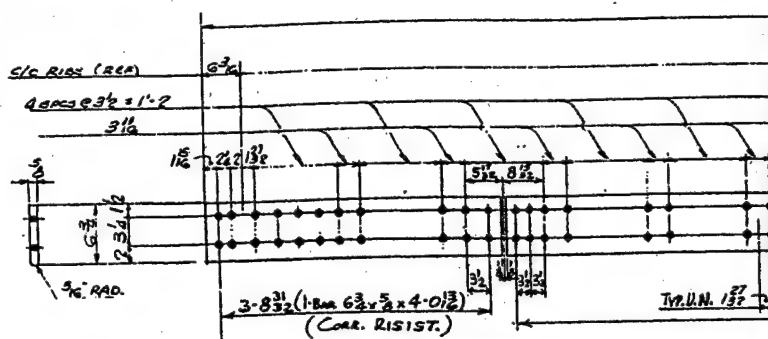
1

FOR INFO - WORLD LENGTH	THIS DRAWING AND INFORMATION IS CONTAINED AND THE PROPERTY OF THE U.S. AIR FORCE. IT IS TO BE KEPT SECRET, AND NOT TO BE DISCLOSED OR USED FOR ANY PURPOSES OTHER THAN THE OFFICIAL PURPOSES OF THE U.S. AIR FORCE.	NAME: <u>NAME</u>
DATE: <u>DATE</u>		POSITION: <u>POSITION</u>

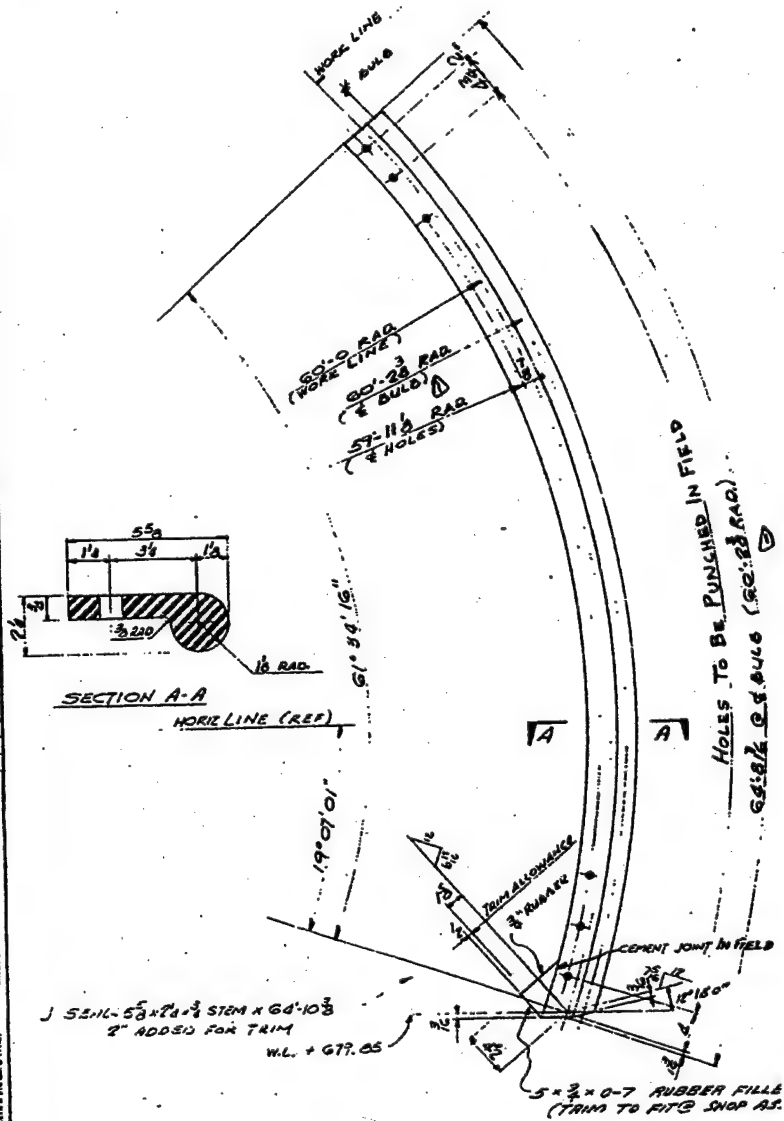


70-C-88-366

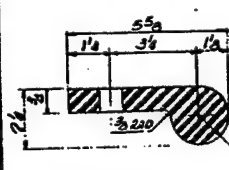
REVISIONS	DATE	BY	CHKD	APP'D
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**16-BOTTOM SEAL CLAMPING BARS-A15**  
(CORROSION RESISTANT STEEL)

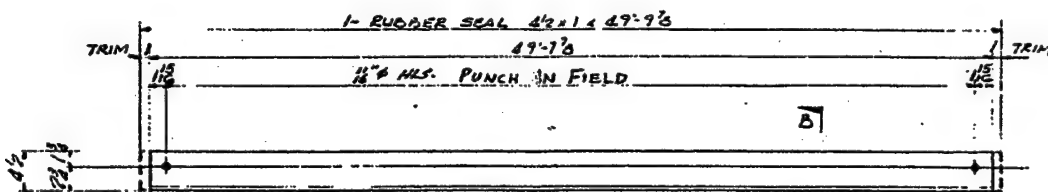
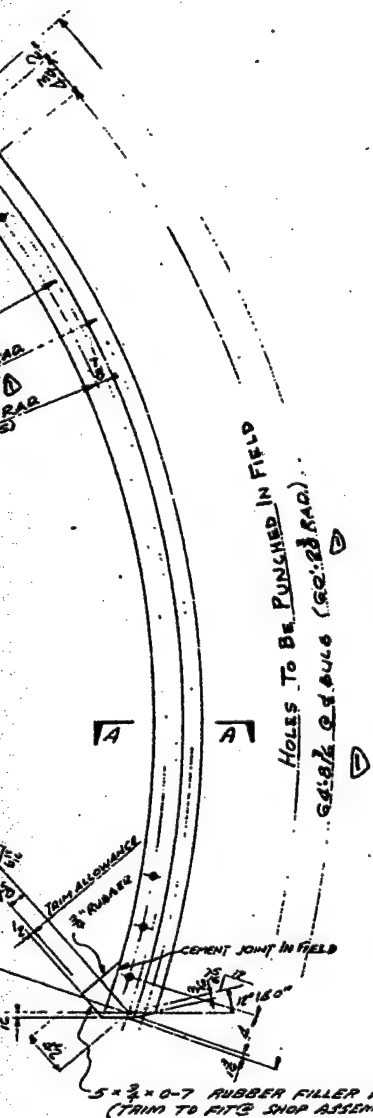
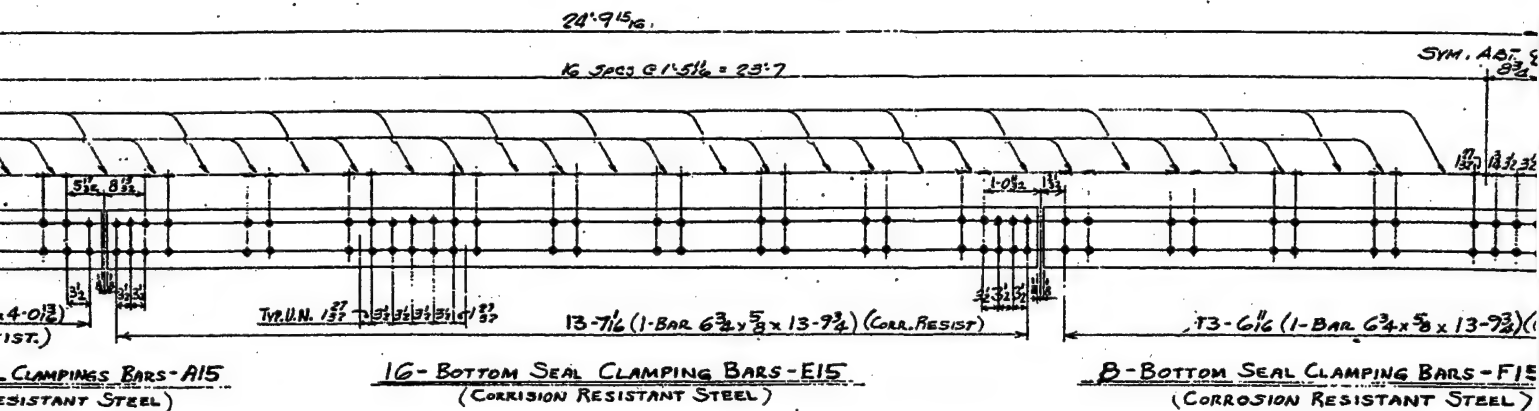


**SECTION A-A**

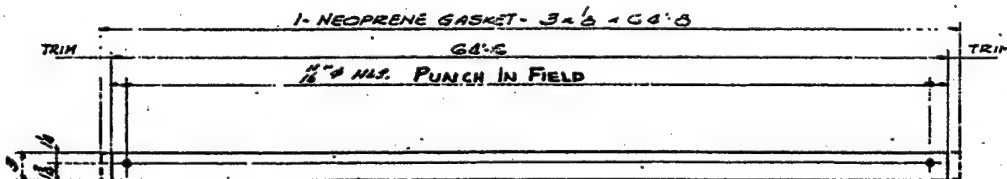


**8-RUBBER 'J' SEALS-THUS- A15**  
**8-RUBBER 'J' SEALS-REV-RB15**

DATE: _____ DRAWN BY: _____ CHECKED BY: _____ APPROVED BY: _____	THIS DRAWING AND INFORMATION IT CONTAINS ARE THE PROPERTY OF THE PLANT OPERATOR. THE DRAWING IS NOT TO BE REPRODUCED OR COPIED IN ANY MANNER WITHOUT THE WRITTEN PERMISSION OF THE PLANT OPERATOR.	HOLE: <u>1/2\"</u> UNLESS NOTED FASTENING: _____ FINISH: _____
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B-RUBBER BOTTOM SEALS-C15



16- GASKETS - D15

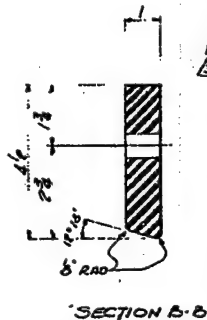
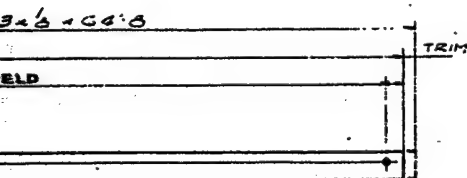
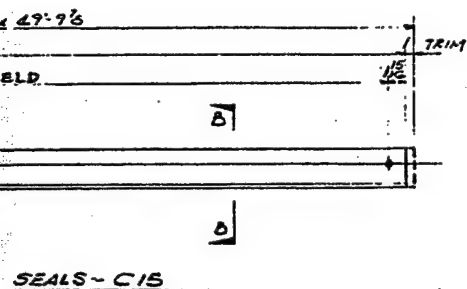
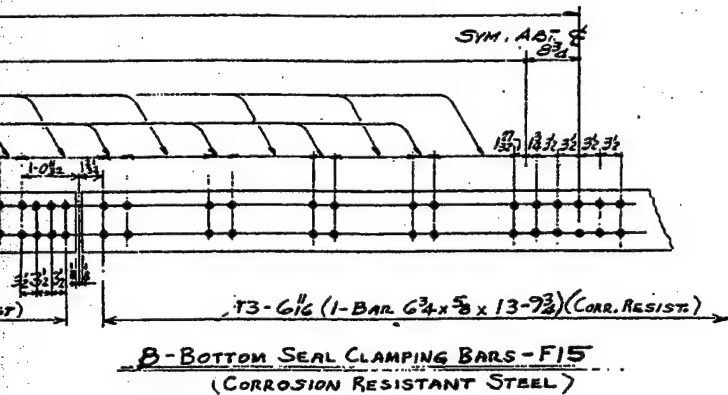
NOTE  
TAG ALL  
WITH IT.

SEALS-THUS- A15

SEALS-REV-RB15

DESIGNED BY: <u>PC</u> DATE: <u>12-8-70</u>	FLINT: <u>1</u>
CHECKED BY: <u>CM</u> DATE: <u>12-22-70</u>	BOX: <u>100</u>
APPROVED BY: <u>CM</u> DATE: <u>12-22-70</u>	ENGR: <u>1</u>
DATE: <u>12-22-70</u>	





NOTE  
TAG ALL MATERIAL  
WITH ITEM NO 132

NO. POS.	MARK	MATERIAL	LENGTH		REMARKS	WEIGHT
			FT.	IN.		
16	A15	BAR 6 3/4" x 5/8"	2	0 1/2	ASTM A276 3/16	
16	E15	BAR 6 3/4" x 5/8"	13	9 3/4	TYPE 3103	
8	F15	BAR 6 3/4" x 5/8"	13	9 3/4	CHEMICALS TO CONFORM S.A. 176, TYPE 4025	
8	B15	RUBBER "J" SEALS	55	7 1/2	STEEL	65 0
8	B15	RUBBER "J" SEALS	55	7 1/2	STEEL	65 0
8	C15	RUBBER SEALS	62	1	47 9/16	
16	D15	NEOPRENE GASKETS	3	2	50 0	NEOPRENE
16	N15	RUBBER FILLER PIECES	5	3	40 7	

NO. REV. NUMBER 132  
CONTRACT NUMBER D&C 68-70-C-0088

APPROVAL STAMP

**APPROVED**

Subject to audit only. All work shall be done in accordance with the contract and the specifications. The Engineer shall be responsible for the design and construction of the project. The Engineer shall be responsible for the design and construction of the project.

LOWER SHAKA RIVER  
RESIDENTS OFFICE

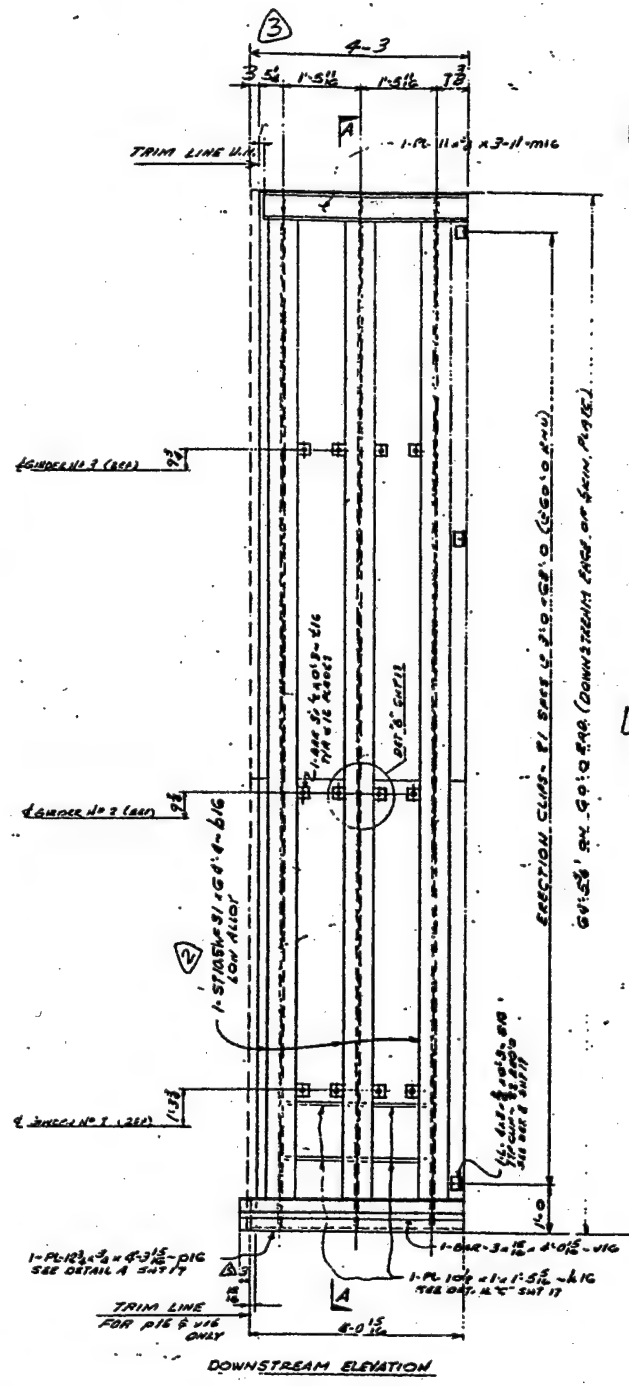
25 SEP 1978

LSR 70-0088-132-020

DESIGNED BY: <u>RE</u> DATE: <u>12-8-70</u>	FLINT STEEL CORPORATION BOX 1899, TULSA, OKLAHOMA 74101 ENGINEERING DEPARTMENT	RUBBER SEALS & CLAMPING ARE LOWER GRANITE LOCK & DAM LOWER GRANITE CONTR. BULLMAN WASH.	JOB NO. 70-0546 SHEET NO. 15 3
CHECKED BY: <u>G.M.</u> DATE: <u>12-22-70</u>			

70-C-88-367

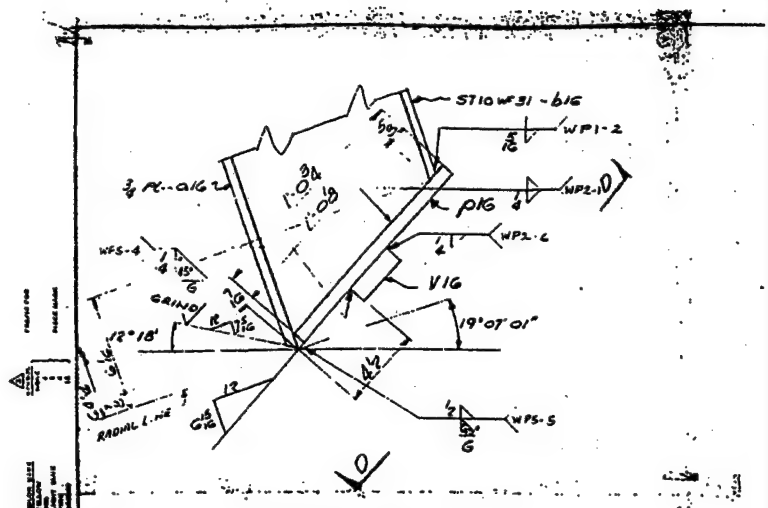
PROJECT NO.	100-100-100
DATE	10-1-60
BY	J. L. B.
CHECKED BY	J. L. B.
APPROVED BY	J. L. B.
SCALE	AS SHOWN
NOTES	SEE DETAIL A FOR SNT 17
REVISIONS	
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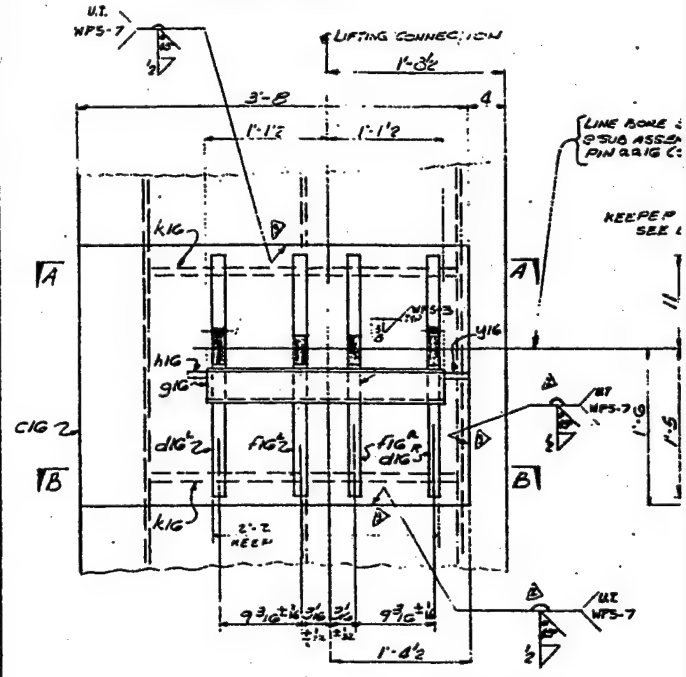
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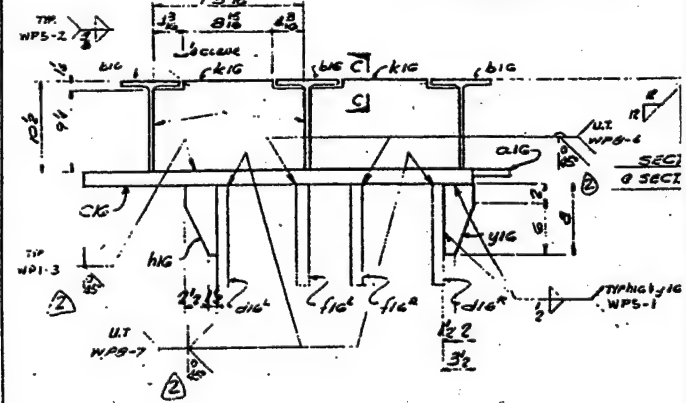




DETAIL "A"



DETAIL "C"



SECTION A-A  
SECTION B-B

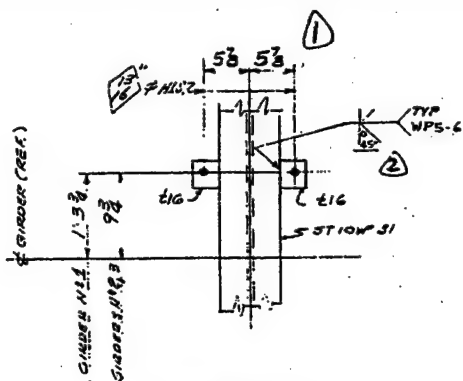
A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
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(1)

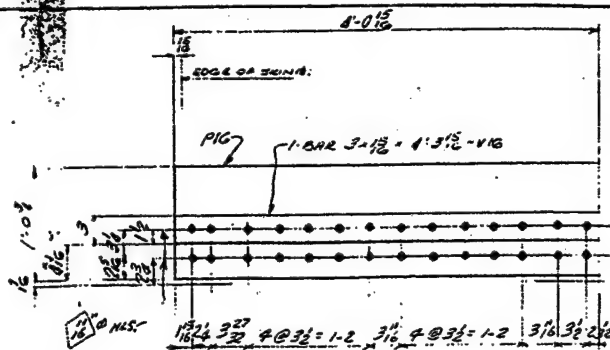
FIELD LENGTH  
FAR SIDE  
NEAR SIDE  
WELD ALL AROUND

THIS DRAWING AND INFORMATION IT CONTAINS ARE THE PROPERTY OF THE PLANT STEEL CORPORATION. THE DRAWING IS NOT TO BE REPRODUCED, COPIED, REPHOTOCOPIED OR USED FOR ANY PURPOSES WITHOUT THE EXPRESS PERMISSION OF THE PLANT STEEL CORPORATION.

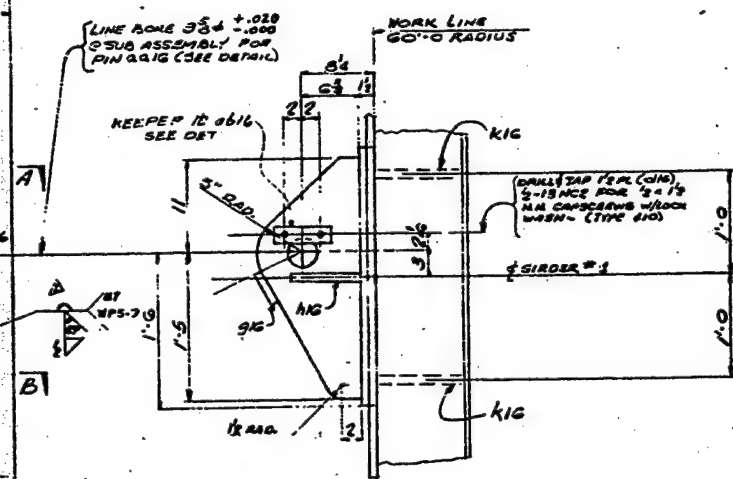
HOLDING  
PATENTED  
PENDING



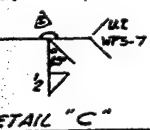
DETAIL "A"  
(TYP RIB TO GIRDER CONN)



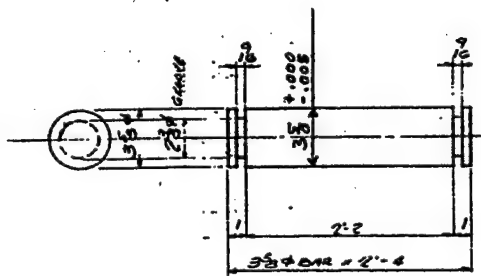
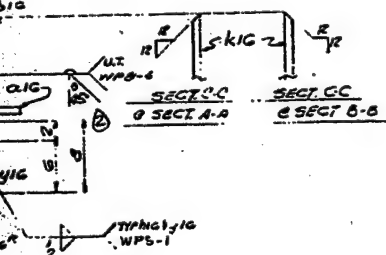
SECTION D-D



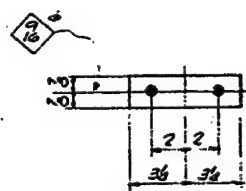
DETAIL "E"  
ERECTION CLIP DETAIL



DETAIL "C"



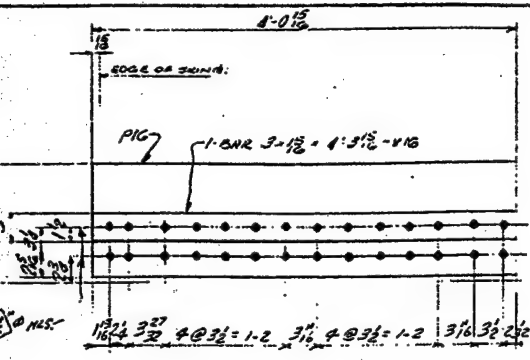
90-S-763 TYPE 410, COND. T.  
(ORANGE 3/8" O.D.)  
16-LIFTING PIN - QAIG



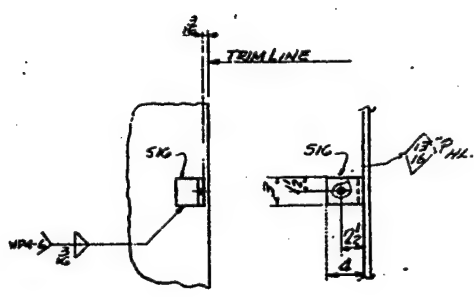
32-BAR - 1/2" x 1/2" O.D. - 0.616  
90-C-753 TYPE 3-3, COND. A

(2)

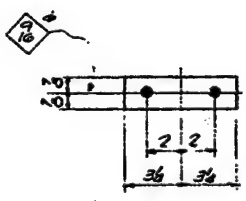
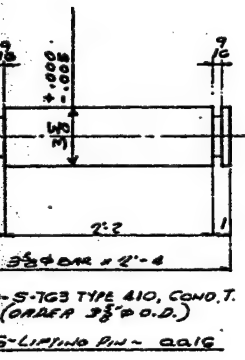
THE DRAWING IS NOT TO BE USED FOR CONSTRUCTION WITHOUT APPROVAL	HOLE: PARTITION: FINISH: NONE	NOTES: 1.	SHOW WL. SIZE @ SECT. D-D REV. DIR. OF BONDING AGENT @ SECT. D-D REV. WELD SYMBOLS REV. P.E. APPROV. SEPR DATED 3-18-77	DESIGNED BY: PE CHECKED BY: PE DATE: 12-12-79	FLINT STEEL BOX 1280, TULSA ENGINEERING
--	-------------------------------------	--------------	--	---	---



SECTION D-D



DETAIL "E"  
ERECTION CLIP DETAIL



32-BAR-1 1/2 x 3 1/2 x 1/8 - 0.616.  
20-C-703 TYPE 3-2, COND. A

NO ITEM NUMBER 132  
CONTRACT NUMBER DHEW-68-70-C-0088

APPROVAL STAMPS

APPROVED

LOWER SNAKE RIVER  
RESIDENT OFFICE

25 SEP 1973

3

LSR70-0088-132-022

RE: @ SECT. D-D

DESIGN: 10-22-70

DATE: 12-9-70

BY: PE

DATE: 12-12-70

BY: C.M.

FLINT STEEL CORPORATION

BOX 1288, TULSA, OKLAHOMA 74101

ENGINEERING DEPARTMENT

SKIN PLATE ASS'Y DETAILS

LOWER GRANITE LOCK & DAM

LOWER GRANITE CENTER

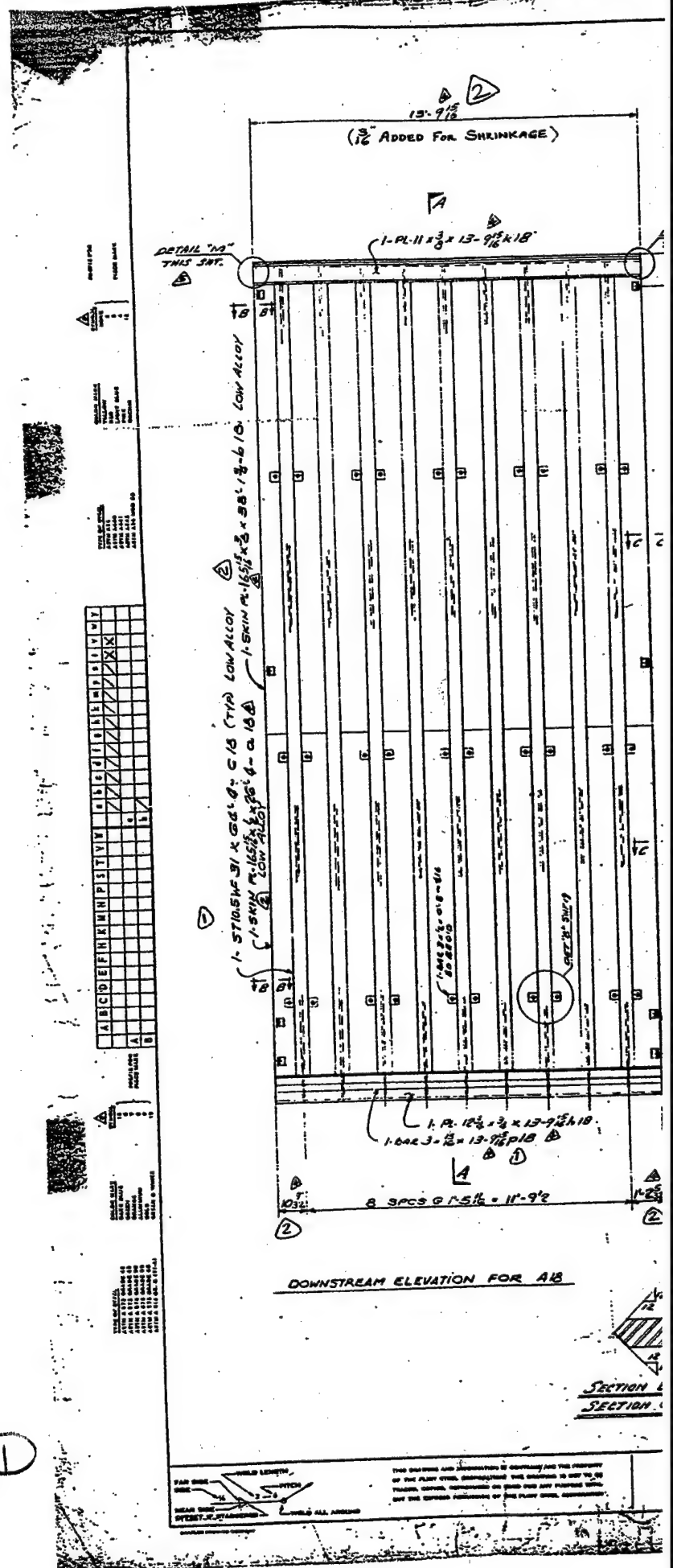
PULLMAN, WASH.

70-0544

FT

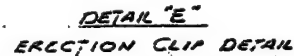
70-C-88-369

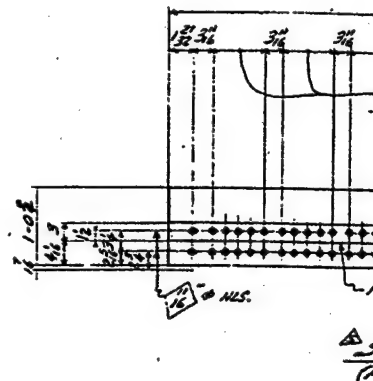




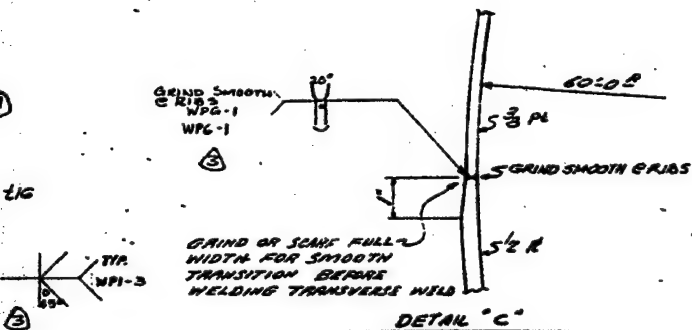




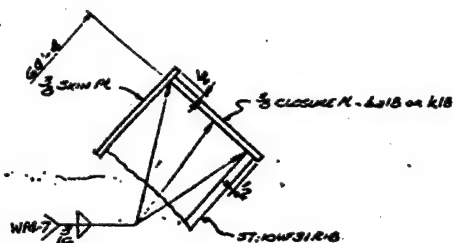




SECTION A-A  
(FOR SKIN SECT. A18)



**DETAIL 'C'**



**DETAN 'D'**

**CONN.**

OF SKIN PL

318

118.  NLS.

**IP DETAIL**

WORK THIS  
WITH SHEP

2

1	SHOW DETAILS & NOTES @ SECT. A-A & B-B	DATE	NAME	04-77
2	STAIN VII - SIZE B, SECT. A-A & B-B	DATE	NAME	05-77
3	CONCRETE FOUND @ DETAIL D-D & DRAW @ SECT. A-A	DATE	NAME	05-77
4	REVISOR WALKER SYMBOLS	DATE	NAME	05-77
5	REVISOR DETAIL & FIN LETTERING A-A & B-B	DATE	NAME	05-77
6	NOT FOR CONSTRUCTION	DATE	NAME	05-77



1

FORM 100  
FEB 68

11

12-UNC

1-BAR 2" x 9'-10" (A4)

128 - STUD BOLTS

DRILL & TAP 1/4-7 UNC  
x 2 1/2" DEEP - 16412 H.A.

5" DIA. HOLE

22.700 ± .002

22.700 ± .002

22.700 ± .002

22.700 ± .002

22.700 ± .002

22.700 ± .002

22.700 ± .002

22.700 ± .002

22.700 ± .002

22.700 ± .002

22.700 ± .002

22.700 ± .002

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22.700 ± .002

22.700 ± .002

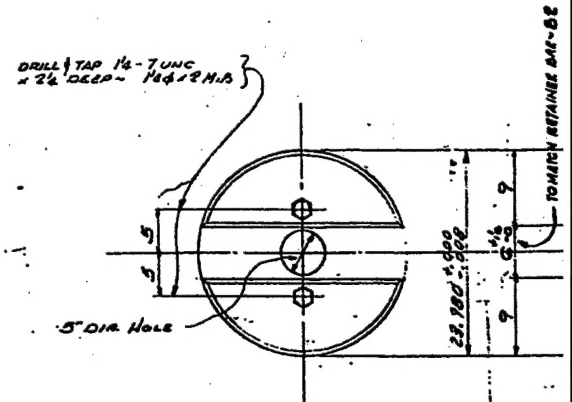
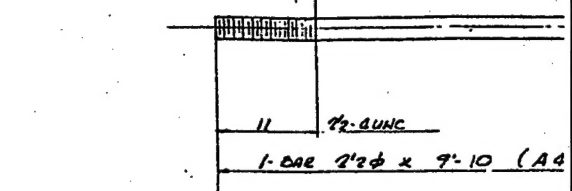
22.700 ± .002

22.700 ± .002

22.700 ± .002

22.700 ± .002

22.700 ± .002

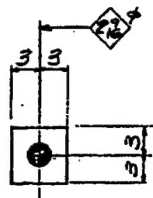


16-TRU

ST  
USE 1/8  
MADE IN  
(SPCS)

THIS DRAWING AND SPECIFICATIONS OF MATERIALS ARE THE PROPERTY  
OF THE UNITED STATES GOVERNMENT AND ARE LOANED TO YOU BY THE  
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GOVERNMENT WHEN NO LONGER NEEDED.





128~PL-6x $\frac{3}{4}$ x0:6~B20 (A490)

128 - STUD BOLTS - A20



STEEL FORGING ASTM A578 CLASS C1.  
USE 1/8" FINISHED THICKNESS WELDED OVERLAY  
MADE WITH E308-15 OR IG ELECTRODE.  
(SPECS AE TP-17-7a OPTION 2)

HQ POS.	MARK	MATERIAL	LENGTH		QUANTITY	REMARKS
			FT.	IN.		
105	A3	2" $\phi$ STUD BOLT	9	10	A490	73
125	B9	FL G $\times$ 3/4	0	6	A490	
16	C20	PIN 24" $\phi$	3	7 1/4		SEE DETAIL
32		14" MA	0	2		77 IN. MAX. LENTH COL. HOLE FF-B-5756
FIELD BOLTS (ACTUAL COUNT)						
32		1" MA	0	6		NEA NO. TNG. 3 1/2" NonNut FF-B-5756
704		3/4" MA	0	24		NEA NO. NEA NO. 1 COAR. LBS
724		3/4" MA	0	8 1/2		NEA NO. NEA NO. 1 COAR. LBS
744		3/4" MA	0	3 1/4		NEA NO. NEA NO. 1 COAR. LBS
704		5/8" FLAT WASH				NEA NO. 1
8152		5/8" LOCK WASH				NEA NO. 1
256	D20	2" 2" HX NUTS			A490	
128	E20	2" 2" HX WASH			A490	
SHOP ASSEMBLY & FIELD PIN UP BOLTS (ACTUAL COUNT)						
704		3/4" MA	0	2		
32		3/4" MA	0	24		
64		3/4" MA	0	24		
32		3/4" MA	0	3		
64		3/4" MA	0	5 1/2		
64		3/4" MA	0	4 1/2		
704		3/4" MA	-	-		
(TO BE REMOVED FROM TENDS) (BRACES AFTER SHOP ASSEMBLY)						
312		3/4" H.S. B. 1/2" - 0	2	2		

NO ITEM NUMBER 132  
CONTRACT NUMBER DACW-68-3-C-0002

Subject to the condition that the Government shall not be liable for the cost of the purchase of the land, and shall not be liable for the cost of the purchase of the land, and shall not be liable for the cost of the purchase of the land.

LOWER SNAKE RIVER  
RESIDENT OFFICE

RESIDENT OFFICE  
JAN 27 1951

LSR 70-0088-133402

70-C-88-372

OCT 13 1981